

Digitized by the Internet Archive
in 2023

Q

180

P3

A32

V. 7-11

JAN 1958-

APR 1963

WARE

מוסד ויצמן • פרסומים במדעי הטבע ובטכנולוגיה בישראל • ירושלים • Jernsalem • The Weizmann Science Press of Israel

Volume 7B, Number 1-2, January-April 1958

30

BULLETIN OF THE RESEARCH COUNCIL OF ISRAEL

Section B ZOOLOGY

Bull. Res. Council of Israel B. Zoology

Page

- 1 An annotated list of the decapod crustacea of the Mediterranean coast of Israel, with an appendix listing the decapoda of the eastern Mediterranean *L. B. Holthuis and E. Gottlieb*

BULLETIN OF THE RESEARCH COUNCIL OF ISRAEL

MIRIAM BALABAN, *EDITOR*

EDITORIAL BOARDS

SECTION A: MATHEMATICS, PHYSICS AND CHEMISTRY

E. D. BERGMANN
A. DVORETZKY
A. KATCHALSKY
J. NEUMANN
F. OLLENDORFF
G. RACAH
M. REINER

SECTION C: TECHNOLOGY

A. BANIEL
J. BRAVERMAN
A. DE LEEUW
M. LEWIN
F. OLLENDORFF
M. REINER
A. TALMI

GOLDBERG, *Technion Publications Language Editor*

SECTION B: BIOLOGY AND GEOLOGY

S. ADLER
F. S. BODENHEIMER
M. EVENARI
N. LANDAU
L. PICARD

SECTION D: BOTANY

M. EVENARI
N. FEINBRUN
H. OPPENHEIMER
T. RAYSS
I. REICHERT
M. ZOHARY

SECTION E: EXPERIMENTAL MEDICINE

S. ADLER
A. DE VRIES
A. FEIGENBAUM
M. RACHMILEWITZ
B. ZONDEK

יוצא לאור ע"י

מוסד ויצמן לפרסומים במדעי הטבע ובטכנולוגיה בישראל
המועצה המדעית לישראל - משרד החינוך והתרבות - האוניברסיטה העברית בירושלים
הטכניון — מכון טכנולוגי לישראל - מכון ויצמן למדע - מוסד ביאליק

Published by

THE WEIZMANN SCIENCE PRESS OF ISRAEL

Research Council of Israel • Ministry of Education and Culture

The Hebrew University of Jerusalem • Technion—Israel Institute of Technology

The Weizmann Institute of Science • Bialik Institute

Manuscripts should be addressed:

The Editor, The Weizmann Science Press of Israel, P.O.B. 801, Jerusalem
33, King George Ave., Telephone 62844

BULLETIN OF THE RESEARCH COUNCIL OF ISRAEL

Section B ZOOLOGY

Bull. Res. Council of Israel B. Zoology

Page

- 1 An annotated list of the decapod crustacea of the Mediterranean coast of Israel, with an appendix listing the decapoda of the eastern Mediterranean *L. B. Holthuis and E. Gottlieb*

**BULLETIN
OF THE RESEARCH COUNCIL
OF ISRAEL**

MIRIAM BALABAN
Editor

EDITORIAL BOARDS

**SECTION A
CHEMISTRY**

SECTION F

MATHEMATICS and PHYSICS

E. D. BERGMANN
A. DVORETZKY
A. KATCHALSKY
J. NEUMANN
F. OLLENDORFF
G. KACAH
M. REINER

**SECTION B
ZOOLOGY**

**SECTION G
GEOLOGY**

S. ADLER
F. S. BODENHEIMER
M. EVENARI
N. LANDAU
L. PICARD

**SECTION C
TECHNOLOGY**

A. BANIEL
J. BRAVERMAN
A. DE LEEUW
M. LEWIN
F. OLLENDORFF
M. REINER
A. TALMI
E. GOLDBERG,

*Technion Publications Language
Editor*

**SECTION D
BOTANY**

M. EVENARI
N. FEINBRUN
H. OPPENHEIMER
T. RAYSS
I. REICHERT
M. ZOHARY

SECTION E

EXPERIMENTAL MEDICINE

S. ADLER
A. DE VRIES
A. FEIGENBAUM
J. GROSS
M. RACHMILEWITZ
B. ZONDEK

Orders in America should be addressed to Interscience Publishers Inc., New York, N. Y., and in England and Europe to Wm. Dawson & Sons, Ltd., Cannon House, Macklin Street, London, W. C. 2, directly or through booksellers.

Annual subscription per section (four issues): IL. 6.000 (\$ 6.00, £ 2.20) Single copy IL. 1.500 (\$ 1.50, 12s.)

Manuscripts should be addressed: The Editor, The Weizmann Science Press of Israel, P.O.B. 801, Jerusalem, 33 King George Ave. Telephone 62844

NOTICE TO CONTRIBUTORS

Contributors to the *Bulletin of the Research Council of Israel* should conform to the following recommendations of the editors of this journal in preparing manuscripts for the press.

Contributions must be original and should not have been published previously. When a paper has been accepted for publication, the author(s) may not publish it elsewhere unless permission is received from the Editor of this journal.

Papers may be submitted in English and in French.

MANUSCRIPT

General

Papers should be written as concisely as possible. MSS should be typewritten on one side only and double-spaced, with side margins not less than 2.5 cm wide. Pages, including those containing illustrations, references or tables, should be numbered.

The Editor reserves the right to return a MS to the author for retyping or any alterations. Authors should retain copies of their MS.

Spelling

Spelling should be based on the Oxford Dictionary and should be consistent throughout the paper. Geographic and proper names in particular should be checked for approved forms of spelling or transliteration.

Indications

Greek letters should be indicated in a legend preceding the MS, as well as by a pencil note in the margin on first appearance in the text.

When there is any room for confusion of symbols, they should be carefully differentiated, e.g. the letter "l" and the figure "1"; "O" and "0".

Abbreviations

Titles of journals should be abbreviated according to the *World List of Scientific Periodicals*.

Abstract

Every paper must be accompanied by a brief but comprehensive abstract. Although the length of the abstract is left to the discretion of the author, 3% of the total length of the paper is suggested.

References

In Sections A and C, and in Letters to the Editor in all Sections, references are to be cited in the text by number, e.g., ... Taylor³ ... and are to be arranged in the order of appearance.

In Sections B, D, E, and G, the references are to be cited in the text by the author's name and date of publication in parentheses, e.g., ... (Taylor 1932).... If the author's name is already mentioned in the text, then the year only appears in the parenthesis, e.g., ... found by Taylor(1932).... The references in these Sections are to be arranged in alphabetical order.

In Section F references are to be cited in the text by number in square brackets, e.g., ... Taylor [3]... and are to be arranged in alphabetical order.

The following form should be used:

3. TAYLOR, G. I., 1932, *Proc. roy. Soc.*, A138, 41.
- Book references should be prepared according to the following form:
4. JACKSON, F., 1930, *Thermodynamics*, 4th ed., Wiley, New York

TYPOGRAPHY

In all matters of typography the form adopted in this issue should be followed. Particular attention should be given to position (of symbols, headings, etc.) and type specification.

ILLUSTRATIONS

Illustrations should be sent in a state suitable for direct photographic reproduction. Line drawings should be drawn in large scale with India ink on white drawing paper, bristol board, tracing paper, clue linen, or blue-lined graph paper. If the lettering cannot be drawn neatly by the author, he should indicate it in pencil for the guidance of the draftsman. Possible photographic reduction should be carefully considered when lettering and in other details.

Half tone photographs should be on glossy contrast paper.

Illustrations should be mounted on separate sheets of paper on which the caption and figure number is typed. Each drawing and photograph should be identified on the back with the author's name and figure number.

The place in which the figure is to appear should be indicated in the margin of the MS.

PROOFS

Authors making revisions in proofs will be required to bear the costs thereof. Proofs should be returned to the Editor within 24 hours, otherwise no responsibility is assumed for the corrections of the author.

REPRINTS

Reprints may be ordered at the time the proof is returned. A table designating the cost of reprints may be obtained on request.

1127A

AN ANNOTATED LIST OF THE DECAPOD CRUSTACEA OF THE MEDITERRANEAN COAST OF ISRAEL, WITH AN APPENDIX LISTING THE DECAPODA OF THE EASTERN MEDITERRANEAN

L. B. HOLTHUIS

Rijksmuseum van Natuurlijke Historie, Leiden, Holland

and

E. GOTTLIEB

Sea Fisheries Research Station, Haifa

I. INTRODUCTION

The publications dealing with the carcinological fauna of the Mediterranean coast of Israel are very few in number and practically all date from the last 30 years. The oldest record of a Decapod Crustacean from the Israel region is Aristotle's description of a crab, which clearly is *Ocypode cursor* (L.), from Phoenicia. Hasselquist (1757) in his *Iter Palaestinum* mentioned two marine Decapods, but these were not actually observed by him in Israel : *Ocypode cursor* (L.), which under the name *Cancer anomalus* was extensively dealt with by Hasselquist on pp. 433-438 of his book, was reported from "Maris fundus & litora circa Aegyptum & Syriam"; the same species was indicated on pp. 593 and 614 of the same book with the name *Cancer cursor*. The other species, *Pontonia pinnophylax* (Otto), was first mentioned by Hasselquist on p. 450 as "Astacus minimus testa molli" and said to inhabit *Pinna*, no locality being cited here; later (p. 572) Hasselquist referred to the species as "en liten Råka" (a small shrimp) and made it clear that he obtained it in Smyrna. The 1890-1894 expeditions of the Austrian ship "Pola" in the E Mediterranean on a few occasions visited the waters near the Israel coast and collected there two species of Sergestidae (*Sergestes corniculum* Kröyer and *Lucifer typus* H. Milne Edwards). Bodenheimer (1920, pt. 2, p. 35) in his *Die Tierwelt Palästinas* mentioned that there "leben zahlreiche Krebse (Crustaceen) im Mittelmeer", but no species were mentioned by name. As far as is known to us the first Decapod species to be actually reported from the Israel coast is the Indo-West Pacific immigrant *Portunus pelagicus* (L.), which under the name *Neptunus pelagicus* was mentioned from Haifa by Fox (1924, p. 715). This first record is followed by several others

published in larger or smaller papers in which Decapods from Israel and neighbouring countries are treated. Of great importance for the knowledge of the carcinological fauna of the Mediterranean coast of Israel are Gruvel's (1928, 1929, 1930, 1930a, 1931) and Monod's (1930, 1931, 1932) studies on the Decapoda of the Syrian coast. In 1933 Steinitz, after having published in 1932 some smaller notes on Decapoda from Haifa, published the first extensive list of Israel species of that group. Additional lists were published later by Bodenheimer (1935, 1937) and Gottlieb (1953). In the meantime, a few smaller notes on the Israel Decapods were published by other authors. The total number of Decapod species mentioned in the literature from the Mediterranean waters of Israel amounts to 59 (23 Macrura, 7 Anomura, and 29 Brachyura).

In this paper an attempt is made to give a complete list of all the Decapoda known at present from the Mediterranean coast of Israel. The basis of this account is formed mainly by the Decapod material in the collection of the Sea Fisheries Research Station at Haifa. This material originates from different sources. Part of the larger forms, such as most Penaeids, were obtained in trawl-nets off the Israel coast, part has been brought together during an intensive investigation of the bottom fauna of Israel waters which from 1946 to 1950 was carried out under the supervision of Dr. A. Wirszubski, and in 1951 and later, under that of Mr. E. Gottlieb. Also material collected in rock pools and other habitats along the coast is included. Further Israel material was placed at our disposal by the following institutions: Kfar Malal Independent Biological Laboratories (through the kindness of Dr. J. Carmin), Institute of Natural Science, Oranim (through the kindness of Mr. A. Abulafia), Tel Aviv Institute of Natural Science (through the kindness of Messrs. L. Fishelson and Ch. Levinson). Finally, Israel material could be examined in the British Museum (Natural History), London, thanks to the kind assistance of Dr. Isabella Gordon.

A duplicate set of the material studied, including the holotypes of the new species, is stored in the Rijksmuseum van Natuurlijke Historie, Leiden.

The present study increased the number of Decapod species known from Mediterranean Israel waters by not less than 58, the total number of species known from there being at present 118 (45 Macrura, 20 Anomura, and 53 Brachyura). These 118 species are treated here in systematical order. Under each species we have listed all the references to Israel specimens that we could find in the literature. In the text the abbreviations cb. and cl. are used for "carapace breadth" and "carapace length" respectively.

It is self-evident that the present list does not give a complete picture of the Israel Mediterranean Decapod fauna and it is to be expected that in the future numerous forms will be added to this list. This is the more probable since several species of Decapoda not yet found on the Israel shores, have been reported from the E Mediterranean. The data on the Decapoda of the E Mediterranean are scat-

tered in a number of publications, while no comprehensive account of this group has ever been published. Since in the course of the preparation of this report most of these publications on E Mediterranean Decapoda have been consulted by us, it seems worthwhile to save future zoologists the trouble of collecting this information again and for this reason we have appended to this paper a list of the Decapod Crustacea that have been reported from the E Mediterranean (east of 20° E), with references to the localities where they have been found.

II. LIST OF THE BOTTOM SAMPLES, CONTAINING DECAPOD CRUSTACEA

The material was collected during (a) the 1953-1956 bottom investigations of Haifa Bay (samples 50-420), and (b) the 1947-1952 bottom investigations off the Israel coast (samples 500-1069).

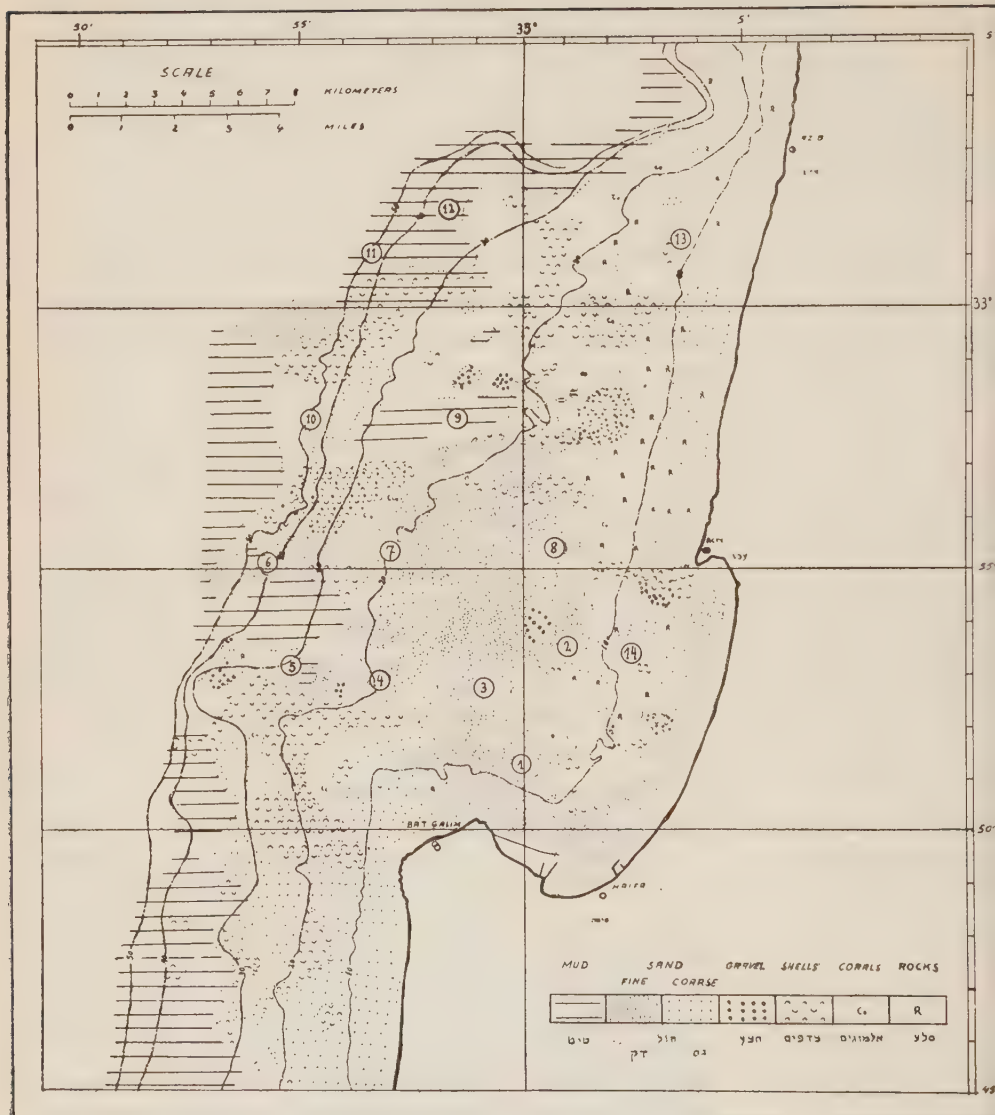
(a) *Haifa Bay bottom investigations (1953-1956)*

The Haifa Bay samples have been collected at various stations, the exact position of which is given in Table I and on Map 1.

In Table II, of each sample containing Decapoda, the station number, the depth, the collecting date and the gear used are given. The indication 1→2 (1) under the station number means: between stations 1 and 2, but closer to 1. The depth is given in meters. The abbreviations G and D in the column gear mean "grab" and "dredge", respectively.

TABLE I
Position of the Haifa Bay stations

Station number	Latitude	Longitude	Depth m
1	32° 51' 17" N;	35° 0' 0" E	24
2	32° 53' 36" N;	35° 1' 0" E	27—29
3	32° 52' 42" N;	34° 39' 0" E	29—31
4	32° 52' 54" N;	34° 56' 36" E	35—37
5	32° 53' 12" N;	34° 54' 36" E	53
6	32° 55' 18" N;	34° 54' 12" E	73
7	32° 55' 30" N;	34° 57' 0" E	37—38
8	32° 55' 30" N;	35° 0' 42" E	33—35
9	32° 58' 0" N;	34° 58' 36" E	42—44
10	32° 58' 0" N;	34° 55' 18" E	82
11	33° 1' 6" N;	34° 56' 36" E	82—88
12	33° 2' 0" N;	34° 58' 18" E	64
13	33° 1' 6" N;	35° 3' 30" E	27
14	32° 53' 6" N;	35° 2' 12" E	18



Map 1

Haifa Bay with the indication of stations in which bottom samples were collected.

TABLE II

Sample number	Station number	Depth m	Date	Gear used
52	2	18	23.VIII.53	G
54	3 → 4 (3)	27—33	23.VIII.53	D
56	4	49—51	23.VIII.53	D
60	9	51	24.VIII.53	G
62	11	55	24.VIII.53	G
71	1 → 14 (1)	18	27.IX.53	D
72	14	18	27.IX.53	G
74	8	33	27.IX.53	G
75	7	38	27.IX.53	G
77	5	55	27.IX.53	G
78	4	37	27.IX.53	G
79	12	64	28.IX.53	G
82	9	38	28.IX.53	G
84	14	18	28.II.54	G
88	5	55	28.II.54	G
89	6	73	28.II.54	G
91	1 → 5 (1)	26	30.IV.54	D
92	5	57	30.IV.54	G
94	3	29	30.IV.54	G
95	3 → 2 (3)	29	30.IV.54	D
96	2	29	30.IV.54	G
98	1	22	2.VI.54	D
102	3	31	2.VI.54	G
107	6	70	2.VI.54	D
108	8	35	3.VI.54	G
110	11	88	3.VI.54	G
111	10	92	3.VI.54	G
112	7	37—38	3.VI.54	G
117	7	37—38	8.VII.54	G
119	8	33—35	8.VII.54	G
120	8	34	6.IX.54	G
121	9	38—42	6.IX.54	G
123	10 → 6 (10)	73	6.IX.54	D
127	5 → 4 (5)	49	7.IX.54	D
129	4 → 3 (4)	37	7.IX.54	D
132	2	27	7.IX.54	G
133	14	18	7.IX.54	G
135	1	24	7.IX.54	D
137	9	42—44	8.VII.54	G
138	14	18	8.VII.54	G
142	5	59	10.X.54	G
145	14	18	10.X.54	G
147	1	24	10.X.54	D
148	9	42	11.X.54	G
149	9 → 7 (9)	42	11.X.54	D
151	7 → 4 (7)	38	11.X.54	D
152	4	37	11.X.54	D
154	3 → 2 (3)	31	11.X.54	D
155	2	27	11.X.54	D
161	6	73	29.XI.54	G

Sample number	Station number	Depth m	Date	Gear used
163	SW → 12 (12)	70	29.XI.54	D
165	7 → 9 (7)	37—38	30.XI.54	D
167	9 → 8 (9)	38—40	30.XI.54	D
169	8 → 2 (8)	31	30.XI.54	D
171	14	18	30.XI.54	G
173	5	55	23.I.55	G
179	1	24	23.I.55	D
180	7 → 6 (7)	37	24.I.55	D
184	8	33	24.I.55	G
186	10 → 9 (10)	82	5.IV.55	D
190	7 → 6 (7)	37—38	5.IV.55	D
191	6 → 5 (6)	79	5.IV.55	D
192	5	49	5.IV.55	G
195	1 → 14 (1)	24	11.IV.55	D
197	1	24	16.V.55	G
198	1 → 5 (1)	24	16.V.55	D
199	5	55	16.V.55	G
200	5 → 6 (5)	55	16.V.55	D
201	6	70	16.V.55	G
202	6 → 10 (6)	70	16.V.55	D
206	12 → 9 (12)	64	16.V.55	D
207	9	44	16.V.55	G
209	7 → 8 (7)	38	16.V.55	D
211	8	29	16.V.55	G
213	4 → 3 (4)	38	17.V.55	D
214	3	30	17.V.55	G
215	3 → 2 (3)	30	17.V.55	D
217	2 → 14 (2)	27—29	17.V.55	D
218	14	18	17.V.55	D
219	14	18	17.V.55	G
220	1	24	7.VI.55	G
223	3 → 7 (3)	31	7.VI.55	D
224	3 → 7 (7)	33	7.VI.55	D
225	7	38	7.VI.55	G
226	7 → 9 (7)	38	7.VI.55	D
227	9	41	7.VI.55	G
228	9 → 8 (9)	34	7.VI.55	D
231	14	19	7.VI.55	G
233	4 → 5 (5)	49	7.VI.55	D
236	10 → 11 (10)	97	8.VI.55	D
238	12	64	8.VI.55	G
239	12 → 9 (12)	51	8.VI.55	D
240	5	55	29.VII.55	G
241	5 → 4 (5)	55	29.VII.55	D
243	4 → 3 (4)	33	29.VII.55	D
245	3 → 2 (3)	29	29.VII.55	D
247	1	25	29.VII.55	G
249	7	38	2.VIII.55	G
250	7 → 6 (7)	43	2.VIII.55	D
252	6 → 10 (6)	70	2.VIII.55	D
253	10	97	2.VIII.55	G
254	10 → 11 (11)	88	2.VIII.55	D

Sample number	Station number	Depth m	Date	Gear used
257	9 → 8 (9)	42	2.VIII.55	D
258	8	35	2.VIII.55	D
260	5 → 4 (4)	35	18.VIII.55	D
261	4	37	18.VIII.55	G
262	5	55	18.VIII.55	G
263	5 → 6 (6)	55—57	18.VIII.55	D
264	6	73	18.VIII.55	G
265	6 → 7 (6)	46—73	18.VIII.55	D
266	7	38	18.VIII.55	G
267	7 → 9 (7)	40	18.VIII.55	D
268	9	42	18.VIII.55	G
269	9 → 8 (9)	35—37	18.VIII.55	D
270	8	33	18.VIII.55	G
271	8 → 2 (8)	31	18.VIII.55	D
272	8 → 2 (8)	29	18.VIII.55	D
273	2	27	18.VIII.55	D
276	11	88	19.VIII.55	G
277	11 → 12 (11)	92	19.VIII.55	D
278	12	57	19.VIII.55	G
279	12 → 14 (12)	51	19.VIII.55	D
280	14	19	19.VIII.55	G
281	14 → 1 (14)	18	19.VIII.55	D
283	1	22	19.VIII.55	D
284	5	53	21.IX.55	G
285	5 → 6 (5)	55—68	21.IX.55	D
286	6 → 10 (6)	73	21.IX.55	D
287	10	101	21.IX.55	G
288	12	55	21.IX.55	G
289	12 → 11 (12)	55	21.IX.55	D
291	8 → 2 (8)	33	21.IX.55	D
293	4	37	27.IX.55	G
294	4 → 7 (4)	37—38	27.IX.55	D
297	9 → 8 (9)	35	27.IX.55	D
298	2	27—29	27.IX.55	D
299	1	24	27.IX.55	D
303	4 → north	38—44	18.X.55	D
304	7	38	18.X.55	G
305	7 → 9 (7)	38—44	18.X.55	D
306	9	42	18.X.55	G
307	9 → 8 (9)	38—35	18.X.55	D
308	8 → 2 (8)	31	18.X.55	D
312	5 → 6 (5)	55—60	18.X.55	D
315	10 → 8 (10)	51—70	18.X.55	D
316	14 → 1 (14)	20	18.X.55	D
317	14	18	29.XI.55	Beam trawl
318	4 → 5 (5)	37	30.XI.55	D
320	6 → 10 (6)	73	30.XI.55	D
321	10 → 8 (10)	92	30.XI.55	D
322	1	24	1.XII.55	G
324	2	27	1.XII.55	G
325	2 → Haifa port	27	1.XII.55	D
328	4 → 7 (4)	37	28.XII.55	D

Sample number	Station number	Depth m	Date	Gear used
330	7 → 8 (8)	37	28.XII.55	D
332	9	42	30.XII.55	G
334	6 → 5 (6)	53	30.XII.55	D
335	5	51	30.XII.55	G
336	5 → 2 (5)	51	30.XII.55	D
338	5	55	21.II.56	G
339	5 → 6 (5)	57—64	21.II.56	D
344	12 → 9 (12)	49—55	21.II.56	D
346	9 → 8 (8)	33—35	21.II.56	D
348	1	24	21.II.56	G
352	7 → 2 (7)	35—38	22.II.56	D
353	7 → 2 (2)	27—29	22.II.56	D
358	3 → Haifa port	18	22.II.56	D
359	5	55	25.II.56	G
360	5 → 6 (5)	47—59	25.III.56	D
362	6 → 10 (6)	77	25.III.56	D
365	9 → 8 (9)	44	25.III.56	D
370	7 → 2 (7)	33—38	26.III.56	D
373	5	55	24.IV.56	G
374	5 → 6 (5)	55—60	24.IV.56	D
377	10	101	24.IV.56	G
381	12	51	24.IV.56	G
384	9 → 7 (7)	38	24.IV.56	D
385	7	37	24.IV.56	G
388	8 → 14 (8)	33	24.IV.56	D
390	14 → Haifa port	18	24.IV.56	D
394	2 → 1 (2)	29	25.IV.56	D
396	1 → Haifa port	24	25.IV.56	D
397	5	55	13.V.56	G
398	5 → 6 (5)	55—60	13.V.56	D
399	6	75	13.V.56	G
400	6 → 10 (6)	71—75	13.V.56	D
405	12 → 9 (12)	37—68	13.V.56	D
407	9 → 7 (7)	40—42	13.V.56	D
409	7 → 8 (8)	35—37	13.V.56	D
411	8 → Haifa port (8)	35	13.V.56	D
412	4	38	14.V.56	G
413	4 → 3 (4)	35—37	14.V.56	D
414	3	29	14.V.56	G
417	2 → 14 (2)	26—27	14.V.56	D

(b) *Bottom investigations off the Israel coast (1947—1952)*

The bottom samples of these investigations were taken in 14 rays, which lie more or less perpendicular to the Israel coast. These rays are not shown on Map 2; in Table III they are indicated with the name of the coastal village from where they start. As in the previous table the depth is indicated in meters and the abbreviations G and D are used for "grab" and "dredge", respectively.



Map 2.

Mediterranean coast of Israel
with the indication of localities
off which the Decapods were
collected

TABLE III

Sample number	Locality	Depth m	Date	Gear used
504	Nahariya	36	17.VI.47	D
506	Nahariya	57	17.VI.47	D
507	Atlit	16	18.VI.47	D
509	Atlit	35	18.VI.47	D
510	Atlit	54	18.VI.47	D
516	Kfar Vitkin	36	19.VI.47	D
520	Kfar Vitkin	90	19.VI.47	D
522	Tel Aviv	90	20.VI.47	D
523	Tel Aviv	50	20.VI.47	G
524	Tel Aviv	50	20.VI.47	D
525	Tel Aviv	30	20.VI.47	G
526	Tel Aviv	30	20.VI.47	G
527	Tel Aviv	30	20.VI.47	D
528	Nabi Yunis	20	20.VI.47	D
531	Nabi Yunis	54	20.VI.47	G
533	Nabi Yunis	54	20.VI.47	G
535	Nabi Yunis	90	20.VI.47	G
537	Gaza	27	21.VI.47	G
538	Gaza	27	21.VI.47	D
539a	Gaza	54	21.VI.47	G
540	Gaza	90	21.VI.47	G
542	Rafah	23	21.VI.47	G
544	Rafah	23	22.VI.47	D
545	Rafah	36	22.VI.47	G
547	Rafah	54	21.VI.47	G
548	Rafah	54	22.VI.47	D
550	Rafah	90	21.VI.47	D
551	Nahariya	16	23.VII.47	D
552	Nahariya	45	23.VII.47	D
553	Nahariya	45	23.VII.47	G
563	Caesarea	90	24.VII.47	D
565	Caesarea	135	24.VII.47	G
565b	Caesarea	135	24.VII.47	G
567	Herzliya	54	24.VII.47	G
567a	Herzliya	54	24.VII.47	G
568	Herzliya	54	24.VII.47	D
569a	Herzliya	90	24.VII.47	G
573	Nabi Rubin	54	25.VII.47	G
574b	Nabi Rubin	90	25.VII.47	G
575	Nabi Rubin	90	25.VII.47	D
576	Nabi Rubin	145	27.VII.47	G
576a	Nabi Rubin	20	27.VII.47	G
579	Ashkelon	54	27.VII.47	G
579a	Ashkelon	54	28.VII.47	G
580	Ashkelon	54	27.VII.47	D
581	Ashkelon	90	27.VII.47	G
582	Ashkelon	90	25.VII.47	D
614	Atlit	90	27.VIII.47	G
617	Kfar Vitkin	54	28.VIII.47	G
618	Kfar Vitkin	93	28.VIII.47	G

Sample number	Locality	Depth m	Date	Gear used
619	Kfar Vitkin	135	28.VIII.47	G
622	Tel Aviv	90	29.VIII.47	G
624	Nabi Yunis	15	29.VIII.47	G
625	Nabi Yunis	54	29.VIII.47	G
626	Nabi Yunis	90	29.VIII.47	G
627	Nabi Yunis	135	29.VIII.47	G
629	Gaza	45	29.VIII.47	G
631	Gaza	140	29.VIII.47	G
632	Rafah	18	30.VIII.47	G
633	Rafah	45	30.VIII.47	G
637	Nahariya	55	18.IX.47	G
638	Nahariya	70	18.IX.47	G
639	Caesarea	18	19.IX.47	G
641	Caesarea	54	19.IX.47	G
642	Caesarea	94	19.IX.47	G
643	Caesarea	135	26.IX.47	G
645	Herzliya	58	19.IX.47	G
646	Herzliya	92	19.IX.47	G
647	Herzliya	137	19.IX.47	G
648	Nabi Rubin	18	30.IX.47	G
649	Nabi Rubin	54	30.IX.47	G
650	Nabi Rubin	90	30.IX.47	G
652	Ashkelon	54	30.IX.47	G
656	Gaza	56	31.IX.47	G
657	Gaza	90	31.IX.47	G
658	Gaza	135	31.IX.47	G
661	Nahariya	54	11.XI.47	G
665	Atlit	135	12.XI.47	G
667	Kfar Vitkin	54	13.XI.47	G
668	Kfar Vitkin	90	13.XI.47	G
669	Kfar Vitkin	235	13.XI.47	G
671	Tel Aviv	53	14.XI.47	G
673	Tel Aviv	135	14.XI.47	G
677	Gaza	56	15.XI.47	D
678	Gaza	90	15.X.47	D
680	Gaza	54	15.XI.47	D
681	Atlit	18	2.VIII.48	D
682	Caesarea	72	2.VIII.48	D
683	Atlit	72	2.VIII.48	D
684	Caesarea	72	2.VIII.48	D
687	Natanya	18	2.VIII.48	D
688	Natanya	38	2.VIII.48	D
689	Natanya	72	2.VIII.48	D
690	Tel Aviv	18	4.VIII.48	D
691	Tel Aviv	36	4.VIII.48	D
692	Tel Aviv	72	4.VIII.48	D
692a	Caesarea	72	1.IX.48	D
693	Atlit	18	9.IX.48	D
694	Atlit	54	9.IX.48	D
695	Atlit	90	9.IX.48	D
696	Atlit	135	9.IX.48	D
697	Caesarea	18	10.IX.48	D

Sample number	Locality	Depth m	Date	Gear used
698	Caesarea	54	10.IX.48	D
700	Caesarea	135	10.IX.48	D
703	Natanya	90	10.IX.48	D
705	Tel Aviv	18	12.IX.48	D
709	Haifa Bay	19	9.XI.48	D
710	Atlit	54	22.XI.48	D
713	Tel Aviv	135	30.XI.48	D
714	Atlit	90	30.XI.48	D
717	Nabi Rubin	81	30.XI.48	D
718	Tel Aviv	54	30.XI.48	D
720	Natanya	18	2.XII.48	D
723	Atlit	18	23.II.49	D
731	Atlit	54	21.III.49	D
736	Kfar Vitkin	54	19.V.49	D
737a	Tel Aviv	135	23.V.49	D
740	Nabi Rubin	20	24.V.49	D
741	Nabi Rubin	56	24.V.49	D
743	Nabi Rubin	138	24.V.49	D
746	Herzliya	55	25.V.49	D
749	Atlit	135	26.V.49	D
753	Caesarea	18	26.V.49	D
754	Atlit	18	20.V.49	D
763	Caesarea	90	21.VI.49	G
766	Herzliya	54	24.VI.49	G
769	Tel Aviv	137	24.VI.49	G
777	Natanya	90	26.VI.49	G
778	Natanya	137	26.VI.49	G
779	Tel Aviv	90	26.VI.49	G
787	Nabi Yunis	54	18.VIII.49	G
792	Natanya	54	19.VIII.49	G
797	Nabi Rubin	54	20.VIII.49	G
798	Nabi Rubin	90	20.VIII.49	G
800	Tel Aviv	137	20.VIII.49	G
804	Tel Aviv	48	21.VIII.49	G
805	Caesarea	90	23.VIII.49	G
806	Caesarea	54	23.VIII.49	G
809	Atlit	54	26.IX.49	G
813	Nabi Yunis	50	6.X.49	G
817	Nabi Rubin	54	7.X.49	G
820	Natanya	54	9.X.49	G
821	Tel Aviv	54	9.X.49	G
823	Caesarea	18	16.X.49	G
824	Caesarea	54	16.X.49	G
830	Nabi Rubin	90	24.X.49	G
832	Nabi Rubin	30	28.XI.49	G
835	Herzliya	45	1.XII.49	G
837	Tel Aviv	90	12.XII.49	G
838	Tel Aviv	54	12.XII.49	G
840	Nabi Rubin	54	13.XII.49	G
844	Natanya	18	14.XII.49	G
845	Natanya	54	14.XII.49	G
848	Herzliya	67	14.XII.49	G

Sample number	Locality	Depth m	Date	Gear used
851	Nabi Yunis	90	14.XII.49	G
887	Bat Yam	22	25.III.50	G
980	Caesarea	46	19.VI.51	G
983	Natanya	46	14.VI.51	G
984	Natanya	137	14.VI.51	G
990	Nabi Rubin	137	13.VI.51	G
992	Nabi Yunis	46	12.VI.51	G
1001	Nahariya	18	7.VIII.51	G
1002	Atlit	46	8.VIII.51	G
1004	Caesarea	46	9.VIII.51	G
1008	Natanya	137	9.VIII.51	G
1024	Ashkelon	46	10.IX.51	G
1028	Nabi Rubin	18	11.IX.51	G
1029	Nabi Rubin	45	11.IX.51	G
1033	Atlit	137	13.IX.51	G
1034	Nahariya	18	13.XI.51	G
1048	Tel Aviv	46	19.XI.51	G
1051	Nabi Rubin	46	20.XI.51	G
1056	Ashkelon	46	21.XI.51	G
1063	Nahariya	137	25.V.52	G
1069	Atlit	54	28.XII.52	G

III. ENUMERATION OF THE CRUSTACEA DECAPODA KNOWN FROM THE MEDITERRANEAN COAST OF ISRAEL

Suborder *MACRURA*

Supersection *NATANTIA*

Section *PENAEIDEA*

Family *SERGESTIDAE*

Subfamily *SERGESTINAE*

Sergestes corniculum Kröyer, 1855

Sergestes corniculum König 1895, p. 13.

No Israel representatives have been seen by us, but larval stages are stated by König (1895) to be abundant in the surface waters of the entire region between $2^{\circ}6'$ — $36^{\circ}32'$ N and $19^{\circ}44'$ — $34^{\circ}33'$ E, and therefore probably have been found very close to the Israel coast.

The species is known from the entire Mediterranean, from the E Atlantic between 47° N and 34° S, and from the Bay of Bengal.

Subfamily LUCIFERINAE

Lucifer typus H. Milne Edwards, 1837

Lucifer Reynaudii Adensamer 1898, p. 602.

Ten specimens (length about 10 mm) were examined. They were collected with a plankton net between 45 and 137 m (vertical haul) off Nabi Rubin on 13.II.56. As Dr. B. Komarovskiy, head of the plankton laboratory of the Haifa Sea Fisheries Research Station informed us, the species is common in the Israel inshore waters.

Adensamer (1898) already reported the species from near the Israel coast 32°46' N, 34°8' E, and 32°43' N, 34°33' E. In both these localities it was found in surface waters.

Lucifer typus inhabits the entire Mediterranean and the Atlantic Ocean between about 42° N and 41° S; it is known also from the Bay of Bengal, the South China Sea, the Malay Archipelago, the Great Barrier Reef area, Wake Island, and the Hawaiian Archipelago. In the E Mediterranean the species has been reported from numerous localities between 31°33'—37°15' N, 20°06'—35°18' E (Adensamer 1898), and from the northern part of the Aegean Sea, 40°8' N, 24°42' E (Adensamer 1898).

Family PENAEIDAE

Subfamily SOLENOCERINAE

Solenocera membranacea (Risso, 1816)

Solenocera membranacea Gottlieb 1953, p. 440.

One specimen (52 mm long) collected near Tel Aviv during Wirszubski's bottom investigations (sample 673, depth 135 m). It is on this specimen that Gottlieb (1953) Israel record of the species is based.

Solenocera membranacea, often named *Solenocera siphonoceros*, is known from the entire Mediterranean and from the E Atlantic between Ireland and Africa. It has been found in depths from about 20 down to 760 m; the specimens met with in superficial waters are mostly juveniles, the adults usually being found in the deeper parts. The previous records of this species from the E Mediterranean are: NW of Crete, 35°59' N 22°56' E (Adensamer 1898), 36°7' N 23°8' E (Steindachner 1891, Adensamer 1898), E of the Peloponnesus, 36°40' N 23°52' E (Steindachner 1891), Sea of Marmara, 40°54' N 28°53' E, 40°45' N 27°43' E and 40°48' N 27°59' E (Stephensen 1923), Israel (Gottlieb 1953).

Subfamily ARISTEINAE

Aristeus antennatus (Risso, 1816)

Aristeus antennatus Gottlieb 1953, p. 440.

This species is not very common off the coast of Israel, where it is caught by trawling.

lers during spring and autumn in depths exceeding 180 m; it lives on a muddy bottom. The largest specimen collected measured 220 mm.

Aristeus antennatus inhabits the entire Mediterranean and has also been reported from the E Atlantic between Portugal and the Cape Verde Islands. It is known from depths between 200 and 1440 m. We do not know of any previous reports of this species from the E Mediterranean, apart from Gottlieb's (1953) record from Israel.

***Aristaeomorpha foliacea* (Risso, 1827)**

Aristeomorpha foliacea Gottlieb 1953, p. 440.

Aristaeomorpha is more common off the Israel coast than *Aristeus*. It is caught by trawlers in the same localities and at the same depths as the preceding species. Both are fished for commercially, but are far less important economically than the following five species. The largest specimen of *Aristaeomorpha* from Israel waters examined by us measured 220 mm.

The species inhabits the entire Mediterranean and furthermore has been reported from the E Atlantic (Bay of Biscay and off the Atlantic coast of Morocco), from S and E Africa, and from Indian, Australian and Japanese waters. It has been collected in depths between 350 and 1300 m. The previous records from the E Mediterranean are: W of Crete, 35°50' N 21°30' E (Stephensen 1923), N of Crete, 36°25' N 24°2' E; off SW Turkey, 36°33' N 28°59' E (Adensamer 1898, as *Aristeomorpha mediterranea*), SE of Crete, 33°20' N 27°30' E and 32°50' N 27°10' E (Stephensen 1923), Israel (Gottlieb 1953), off Egypt, 32°6' N 30°12' E (Adensamer 1898, as *Aristeomorpha mediterranea*).

Subfamily PENAEINAE

***Penaeus kerathurus* (Forsk., 1775) (Plate I, fig. 1)**

Penaeus trisulcatus Steinitz 1933, p. 143; Bodenheimer 1935, p. 466 (as *P. trisulcatus*); Bodenheimer 1937, p. 281; Gottlieb 1953, p. 440; Wirszubski 1953, p. 16.

This species is very commonly caught by trawlers on the Israel coastal shelf, especially on a sandy or sandy mud bottom, down to a depth of about 50 m. In deeper waters it is very seldom met with. The species is of commercial value; Steinitz (1933) already mentioned that it is sold on the Haifa fishmarket, where it was then said to be not very common. The average size of the specimens collected is 140 mm. In the British Museum (Nat. Hist.) a female (length 105 mm) from Nabi Rubin (coll. I. Aharoni) was examined.

Penaeus kerathurus (also known as *P. trisulcatus* or *P. caramote*) occurs throughout the Mediterranean and in the E Atlantic from the S coast of England southwards to Angola. The records from the E Mediterranean are: Greece (Sharp 1893), Gulf of Preveza and Gulf of Thessalonike (= Salonique), Greece (Athanasopoulos

1926), Smyrna (= Izmir), Turkey (Forskal 1775), Rhodes (Maldura 1938, Tortonese 1947), Gulf of Alexandretta (= Iskenderon), Turkey (Monod 1931, 1932, Gruvel 1936), Syria (Gruvel 1928, 1931), Israel (Bodenheimer 1935, 1937, Gottlieb 1953, Wirszubski 1953), Haifa, Israel (Steinitz 1933), Egypt (Gruvel 1928), Port Said, Egypt (Balss 1927, Gurney 1927, Monod 1931), Lake Menzaleh near Port Said (Balss 1927, Gurney 1927, Gruvel 1936), Lake Timsah, Suez Canal (Gruvel 1936), Bay of Abukir near Alexandria, Egypt (Balss 1936), Alexandria (Forskal 1775). The specimen from Greece mentioned by Sharp (1893) was recently (1957) examined by Holthuis in the collection of the Academy of Natural Sciences in Philadelphia.

***Penaeus japonicus* Bate, 1888**

Penaeus japonicus Gottlieb 1953, p. 440.

This species is very common along the Israel coast, sometimes being more abundant than *P. kerathurus*. It is found together with that and with the following species, and has a high commercial value. The largest specimen examined by us is a female taken by trawl in the area between Bat Yam and Nabi Yunis (depth 36 m, 5.I.1955); it measured 250 mm. Two juvenile specimens (lengths 23 and 26 mm) of what seems to be this species were collected on 26.X.1955 near the mouth of Naáman River near Acre, while a specimen of 55 mm was obtained on 12.IV.1955 near the Alexander River.

Penaeus japonicus is a species that originally inhabits the Indo-West Pacific region (from the Red Sea and S Africa to Japan and the Malay Archipelago). In recent years it has been observed in the E Mediterranean, where it evidently arrived by way of the Suez Canal. Gruvel (1936, p. 181) mentioned that *P. japonicus* is widely distributed in the Suez Canal and that "on le rencontre dans la Baie de Suez, dans les lacs Amers et le lac Timsah; mais il ne semble pas remonter plus au Nord que ce lac où il est, du reste, peu abondant". Monod (1937) also reported the species from the Suez Canal. Balss (1927), Gurney (1927) and Fox (1927a) mentioned the, likewise Indo-West Pacific, species *P. canaliculatus* (Olivier) from both ends and the middle of the Suez Canal (Port Tewfik, Kabret, and Port Said); their material, which was examined in the British Museum (Nat. Hist.) by Holthuis, proved to belong actually to *P. japonicus*, and had already been identified as such by M. D. Burkenroad. The present species has also been reported from Israel (Gottlieb 1953) and from the Gulf of Alexandretta (= Iskenderon), Turkey (Monod 1930, 1931, 1932). The specimens reported by Gruvel (1928, 1929, 1931) under the name *Penaeus canaliculatus* from Syria and Egypt evidently also belong to the present species.

***Penaeus semisulcatus* De Haan, 1844**

Penaeus semisulcatus Gottlieb 1953, p. 440; Wirszubski 1953, p. 16.

This species is trawled together with the preceding two species on the Israel



1



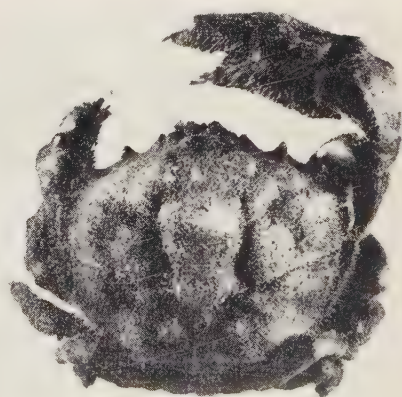
2



3



4



5

FIGURE 1
Penaeus kerathurus (Forsk.).
Animal in lateral view.

FIGURE 2
Scyllarus arctus (Linnaeus).
Animal in dorsal view.

FIGURE 3
Scyllarides latus (Latreille).
Animal in dorsal view.

FIGURE 4
Dardanus arrosor (Herbst).
Animal in lateral view.

FIGURE 5
Dromia personata (Linnaeus).
Animal in dorsal view.

coastal shelf. It has a high commercial value. A female taken in an otter trawl S of Tel Aviv at a depth of 27 m measured 300 mm, while the average size is smaller.

Penaeus semisulcatus, like *P. japonicus*, originally inhabits the Indo-West Pacific area (from the Red Sea and S Africa to Japan, the Malay Archipelago and E Australia). By way of the Suez Canal it has now entered the E Mediterranean. According to Gruvel (1936, p. 181) it is found throughout the Suez Canal, from where it is also mentioned by Monod (1937). Gruvel (1928, 1929, 1930, 1931) reports it from the Syrian coast. Gruvel (1930a, 1931, 1936) and Monod (1930, 1931, 1932) mention it from the Gulf of Alexandretta (= Iskenderon), Turkey. Gruvel in his 1928-1930 publications used the incorrect specific name *P. monodon* Fabr. The species is also found to be quite abundant in night trawl catches in Mersin Bay, Turkey, on the 50 m line. Gottlieb (1953) and Wirszubski (1953) were the first to report the species from Israel.

***Parapenaeus longirostris* (Lucas, 1846)**

Parapenaeus longirostris Monod, 1931, p. 421, figure 24; Bodenheimer 1935, p. 466; Bodenheimer 1937, p. 281; Gottlieb 1953, p. 440; Wirszubski 1953, p. 17.

This is the most common species of the family Penaeidae along the Israel coast. Everywhere in the area of the continental shelf it occurs in very large numbers and also goes down to depths of over 180 m. It is of no commercial value. In Haifa Bay it was dredged on several occasions (samples 191, 202, 252, 286), and it was also found in dredge hauls off Nabi Rubin (sample 575), and off Ashkelon (sample 582). These dredged specimens, which are rather small (being only 40 to 86 mm in length), were collected at depths between 70 and 90 m.

Parapenaeus longirostris occurs throughout the Mediterranean; furthermore, it is known from the E Atlantic between Portugal and Angola, and from the W Atlantic between Massachusetts (U.S.A.) and Venezuela. E Mediterranean records are: Sea of Marmara, 40°54' N 28°55' E (Stephensen 1923), central Sea of Marmara (Ostroumoff 1896, as *Penaeus membranaceus*), E of the Peloponnesus, Greece, 37°0' N 24°28' E, 36°59' N 24°29' E, 36°58' N 24°18' E; off SW Turkey, 36°13' N 30°22' E; N of Cyprus, 35°57' N 32°51' E (Adensamer 1898, as *Penaeus membranaceus*), Gulf of Alexandretta (= Iskenderon), Turkey (Monod 1931, 1932), Israel (Monod 1931, Bodenheimer 1935, 1937, Gottlieb 1953, Wirszubski 1953), Suez Canal "jusque dans le lac Menzaleh, le lac Timsah et le Grand lac Amer" (Gruvel 1936, p. 179). As pointed out by Holthuis (1956, p. 308), Gruvel's record of this species from the Suez Canal possibly is based on incorrectly identified specimens of *Metapenaeus stebbingi* Nobili.

Metapenaeus monoceros (Fabricius, 1798) (Figure 1)

Penaeopsis monoceros Gottlieb, 1953, p. 440; Wirszubski, 1953, p. 16.

This species is caught by trawlers on the Israel continental shelf, especially in the southern areas. It is of commercial value. The average size of the specimens caught is about 150 mm.

Juvenile specimens (length 13—72 mm) were collected in the following localities: mouth of Naáman river near Acre (15.IX.1955: 2 specimens, 24 and 30 mm; 26.X.1955: 1 specimen, 65 mm), Naáman river, halfway between its mouth and the railway bridge (17 and 29.VIII.1955: 10 specimens, 13—65 mm), Kishon river (7.XI.1954: 2 specimens, 43 and 58 mm), Haifa Bay (sample 299, depth 24 m: 1 specimen, 72 mm), near Heftsi-Bah river near Hadera (21.XI.1951: 5 specimens, 47—54 mm).

Metapenaeus monoceros often is considered a species with a wide Indo-West Pacific distribution (from the Red Sea and E Africa to Japan, the Malay Archi-



FIGURE 1.

Metapenaeus monoceros (Fabricius), male from Israel. a, left petasma in anterior view; b, right petasma in posterior view. $\times 7$.

pelago and Australia). However, as pointed out by Racek (1955, p. 232), the specimens from India differ in several respects from those of Australia, mainly in the shape of the male and female genitalia. We therefore have to distinguish between an eastern and a western form. According to Burkenroad, whose opinion was published by Morris and Bennett (1952, p. 165) and cited by Racek, India is the eastern boundary of the western form, the eastern form occurring in Japan, the Malay Archipelago and Australia. Racek correctly kept the specific name *monoceros* for the western form, employing the name *Metapenaeus incisipes* (Bate) for the eastern one. *Penaeus monoceros* was originally described by Fabricius (1798, p. 409) after material of which he remarked "Habitat in Oceano Indico esculentus Dom. Daldorff". As Carl Dagobert de Daldorff, a lieutenant in the Danish East India Company, was stationed at Tranquebar on the E coast of India, his material probably came from that locality so that indeed Fabricius' specimens must have belonged to the western form. To set all doubts aside, we now select Tranquebar, Madras Province, India, as the restricted type locality of *Penaeus monoceros* Fabricius, 1798.

The petasma of an Israel male is figured here. The apical flaps of this organ in their shortness, bluntness and general shape strikingly resemble those shown in Alcock's (1906, plate 3, figure 7b) figure of the petasma of Indian specimens. As shown in Racek's (1955, plate 6, figure 3, 4) and Kubo's (1949, figure 31 E, F) figures, the petasma of the Australian and Japanese *Metapenaeus incisipes* (Bate) differs strongly from that of the Israel and Indian specimens. The thelycum of *Metapenaeus monoceros* is very similar to that of *M. incisipes*, but the lateral margin of the lateral plates is much higher in *M. monoceros* and does not have the posterior extremity bent over inwards as in *M. incisipes*. Also, the thelycum of the Israel specimens is similar to that of the Indian form. Through the kindness of Dr. A. Racek of Sydney, we were able to directly compare our material with Australian material of *M. incisipes*; we fully agree with him that two distinct species are involved here. There is not the slightest doubt that the Israel material belongs to the true *Metapenaeus monoceros* (Fabr.).

The species has evidently entered the E Mediterranean through the Suez Canal as is shown by the following records: Suez Canal (Gruvel 1936, Monod 1937), Great Bitter Lake (Balss 1927, Gurney 1927, Fox 1927a), Port Said (Balss 1927, Gurney 1927, Fox 1927a, Monod 1930, 1931, 1932, Gruvel 1931, 1936, Burkenroad 1934), Bay of Abukir near Alexandria (Balss 1936), Israel (Gottlieb 1953, Wirszubski 1953).

***Trachypeneus curvirostris* (Stimpson, 1860)**

Metapeneus sp. Steinitz 1929, p. 80.

Metapenaeus palaestinensis Steinitz 1932, p. 161, figures 1—3; Burkenroad 1934, pp. 29, 57.

Trachypenaeus curvirostris Steinitz 1933, p. 144, figures 1—3; Steinitz 1933a,

p. 338; Bodenheimer 1935, p. 466, plate 68 figure 1 (*curvirostris* on plate); Bodenheimer 1937, p. 281.

The material examined originates from: Haifa Bay (samples 71, 149, 344), off Atlit (samples 693, 710), off Nabi Rubin (sample 648). All these specimens are juvenile, their lengths varying between 8 and 46 mm; they were collected at depths between 18 and 55 m.

Like so many of the Israel Penaeids, *Trachypeneus curvirostris* is an immigrant from the Indo-West Pacific area, where it has been reported from the Red Sea to Japan, the Malay Archipelago, and Australia. According to Steinitz (1929) the species is so numerous in Haifa Bay during the spring that it is sold on the fish-market.

The species is closely related to, but nevertheless distinct from, *Trachypeneus anchoralis* (Bate), with which it has often been confused. *Trachypeneus curvirostris* may immediately be distinguished from *T. anchoralis* by the presence of epipods on the first and second pereopods. Burkenroad (1934, p. 49) considered the difference between the two species to be of subgeneric value and made *T. curvirostris* the type species of his new subgenus *Trachysalambria*, *T. anchoralis* being the type of the genus *Trachypeneus* Alcock. *Trachypeneus anchoralis* which like *T. curvirostris* is of Indo-West Pacific origin, has been reported from the Suez Canal (Balss 1927 and Fox 1927a: S entrance of the Canal near Port Tewfik, and Lake Timsah; Gruvel 1936, p. 183: "dans la Baie de Suez et jusque dans le lac Timsah"; Monod 1937). The specimens reported upon by Balss and Fox are preserved in the British Museum (Nat. Hist.) and on examination proved to belong to *T. curvirostris*. It is possible that Gruvel's and Monod's specimens also belong to that species. Holthuis (1956) dealt with material of *T. curvirostris* from Great Bitter Lake. Steinitz (1929, 1932, 1933, 1933a) was the first to report this species from Haifa Bay, and no new Mediterranean localities have since been published for this species.

When Steinitz (1932) dealt with this species for the first time, he mistook the arthrobranch at the base of the fourth pereopod (somite XIII) for a pleurobranch and incorrectly placed the species in the genus *Metapenaeus*, describing it as new under the name *Metapenaeus palaestinis*. In the following year, Steinitz (1933, 1933a) recognized his error and corrected it, giving the species its proper name. Burkenroad (1934, pp. 29, 57), commenting on Steinitz' (1932) species, assigned it correctly to the genus *Trachypeneus*, but remarked that Steinitz had described "a rudimentary anterior arthrobranch... on the thirteenth somite". This, however, is incorrect; Steinitz did not indicate any arthrobranch on the thirteenth somite, though he did describe two arthrobranchiae on the twelfth. Burkenroad's supposition that Steinitz' species might differ from the true *Trachypeneus curvirostris* in the presence of an additional arthrobranch on segment XIII, therefore does not hold good: the Israel *Trachypeneus* are completely identical with *T. curvirostris*.

Subfamily SICYONINAE

Sicyonia carinata (Brünnich, 1768)

The only material examined by us originates from Haifa Bay (sample 209, dredge, depth 38 m). It contains two specimens which are 36 and 40 mm long.

The species had not been reported before from Israel. It is known from the entire Mediterranean and from the E Atlantic between Portugal and the Gold Coast. There are, furthermore, reports of this species from the W African coast between the Gold Coast and Angola, and from Brazil, but these records must be considered with a good deal of reserve. E Mediterranean records are: E of the Peloponnesus, Greece, 37°49' N 23°27' E (Stephensen 1923), Phaleron Bay near Athens, Greece (Athanasopoulos 1917), St. Georges Bay, Beirut, and Ras Beirut, Lebanon (Monod 1931), near Alexandria, Egypt (Balss 1936).

Section CARIDEA

Family PASIPHAEIDAE

Leptochela pugnax De Man, 1916

Material of this species was collected at the following localities: off Nahariya (samples 638, 661), Haifa Bay (samples 75, 82, 108, 173, 184, 191, 197, 202, 207, 211, 214, 225, 228, 238, 240, 247, 252, 253, 254, 258, 263, 264, 268, 270, 273, 276, 278, 279, 287, 288, 306, 315, 321, 322, 324, 335, 362, 374, 407, 409, 412, 414; attracted by light at night, 28.VII.1954), off Atlit (samples 614, 665, 693, 695, 696, 710, 714, 723, 809), off Caesarea (samples 565, 641, 684, 697, 698, 806, 823, 824), off Kfar Vitkin (samples 516, 667, 668), off Natanya (samples 687, 689, 820, 845, 983), off Herzliya (samples 567, 568, 645, 647, 835), off Tel Aviv (samples 525, 527, 671, 691, 692, 718, 821, 837, 838), off Nabi Rubin (samples 573, 648, 649, 717, 832, 840, 1029), off Nabi Yunis (samples 528, 533, 625, 813, 851), off Gaza (samples 629, 631, 656), off Rafah (samples 542, 545, 632). The material consists of no less than 183 specimens from 102 samples from numerous localities all along the coast of Israel, and from depths between 18 and 140 m. The lengths of these specimens range from 2 to 16 mm, only six of them are ovigerous. These ovigerous females, which have lengths varying between 13 and 16 mm, were found in samples 268, 533, 567, 629, 641, collected in June, July, August and September.

The specimens agree very well with the description of *Leptochela pugnax* given by De Man (1920, p. 26) and Kemp (1925, p. 255); comparison of our Israel material with specimens from the Malay Archipelago definitely established their identity.

Until now *Leptochela pugnax* has been reported from the Maldivé Archipelago, the Andaman and Nicobar Islands, the Mergui Archipelago, Penang Island, the Malay Archipelago and the Great Barrier Reef. So far it has not been reported

from the Red Sea and its appearance in Israel waters is therefore somewhat surprising. This is the more true since a different species of *Leptochela*, *L. aculeocaudata* Paulson, has been reported from the E. Mediterranean near Alexandria (Balss 1936), where it seems to be well established: 12 specimens, among which an ovigerous female, were collected from 4 different localities. From the Red Sea two species of *Leptochela* are known, the above mentioned *L. aculeocaudata* Paulson and *L. robusta* Stimpson. Judging by the fact that *L. pugnax* has now penetrated into the Mediterranean, its occurrence in the Red Sea becomes most probable, and thus far must have been overlooked. This species may immediately be distinguished from *L. aculeocaudata* and *L. robusta* by the presence of an antennal spine, which is distinct in all our Israel specimens.

Family PALAEMONIDAE

Subfamily PALAEMONINAE

Palaemon (Palaemon) adspersus Rathke, 1837

Leander adspersus Balss 1927, p. 223.

Leander adspersus fabricii Steinitz 1933, p. 146; Bodenheimer 1935, p. 466; Bodenheimer 1937, p. 281.

Four juveniles (length 11 to 21 mm) of this species, originating from Haifa harbour (10. XI. 1946) were examined. The species has been mentioned before from Haifa by Balss (1927), while Steinitz (1933) reported it from "Felsenbecken der Haifabucht".

The nomenclatorially correct name of this species is *Palaemon squilla* (L., 1758) (see Holthuis 1950, pp. 55-56); since, however, the name *squilla* has been used for several other species of this and related genera, it seemed best to drop this specific name altogether and to adopt for it the unambiguous name *adspersus* Rathke. A proposal to have the name *squilla* suppressed and the name *adspersus* validated is now before the International Commission on Zoological Nomenclature (see Holthuis 1957, pp. 142-153). Pending a decision the name *adspersus* is provisionally used here.

Palaemon adspersus is known from the Baltic and SW Norway down to the Mediterranean and the Black Sea; recently it has been introduced into the Caspian Sea. It lives in shallow coastal, sometimes brackish, waters. E Mediterranean records are: Istanbul (= Constantinople) fishmarket (Ninni 1923), Israel (Bodenheimer 1935, 1937), Haifa, Israel (Balss 1927; Steinitz 1933), near Alexandria, Egypt (Forsk. 1775, Balss 1936), Mat-Hafel near Benghazi, Cyrenaica (Colosi 1923).

Palaemon (Palaemon) longirostris H. Milne Edwards, 1837

A single, not yet fully grown specimen (length 22 mm) was collected on 17.VIII. 1955, in the Na'aman River near Acre, about halfway between the railway bridge and the mouth of the river.

De Man (1923) distinguished two forms of this species, one being rather robust (=var. *robusta* De Man), the other more slender. The robust form proves to be the typical *Palaemon longirostris* and is known with certainty from the Atlantic coast of Europe (NW Germany to NW Spain). The slender form was found in the Guadalquivir River in S Spain. Too little is known about the specimens reported from the Mediterranean and the Black Sea regions to assign them to either of the two forms, though it would be reasonable to expect them to be closer to the slender Guadalquivir form than to the typical form of the Atlantic coast of Europe. It is somewhat surprising, therefore, that the Israel specimen is rather robust in shape and agrees well with the typical *Palaemon longirostris*. However, since our Israel material consists of a single specimen, which moreover is not fully grown, nothing definite can be said about its relation to the two forms of the present species.

The only previous record of this species from the E Mediterranean is that by Pfeffer (1889, p. 34), who reported *Palaemon edwardsii* Heller var. from "Graben von Mergui," Alexandria, Egypt.

***Palaemon (Palaemon) xiphias* Risso, 1827**

Leander xiphias Steinitz 1933, p. 146; Bodenheimer 1935, p. 466; Bodenheimer 1937, p. 281; Gottlieb 1953, p. 440.

Of this species four juveniles (lengths 17 to 21 mm) were collected on 5.V. 1953 near Nabi Yunis at a depth of 146 m. Steinitz (1933) reported it from rock pools in Haifa Bay.

Palaemon xiphias is known from the entire Mediterranean and the Canary Islands. It inhabits the littoral zone, and is often found in eel grass. The occurrence of the above mentioned four specimens from Nabi Yunis at a depth of 146 m is rather unusual. Mediterranean records are: Syria (Gruvel 1931), Ras Beirut and St. George's Bay, Beirut, Lebanon (Monod 1931), Israel (Bodenheimer 1935, 1937, Gottlieb 1953), Haifa (Steinitz 1933), near Alexandria, Egypt (Balss 1936).

***Palaemon (Palaemon) serratus* (Pennant, 1777)**

An ovigerous female (length 85 mm), collected near Nabi Rubin, Israel (coll. I. Aharoni), is preserved in the British Museum (Natural History) and was examined there by Holthuis.

The species, which is also known as *Palaemon* (or *Leander*) *treillianus* or *lat-reillianus*, inhabits the entire Mediterranean and is also reported from the Black Sea, and the E Atlantic between Denmark and Mauritania. The records from the E Mediterranean are: Peloponnesus, S Greece (Guérin 1832), Phaleron Bay near Athens, Greece (Athanasopoulos 1917), Bosphorus (Heller 1863, Ostroumoff 1896), Istanbul (=Constantinople) fishmarket (Ninni 1923), Gallipoli, Turkey

(Ostroumoff 1896), Sporades, 36°47' N 26°29' E (Adensamer 1898), Livadia Bay, Episkopi (=Piskopi), Sporades (Santucci 1928), Syria (Gruvel 1928, 1931), Egypt (Gruvel 1928), Port Said, Egypt (Balss 1927, Gurney 1927a, Monod 1931), Benghazi, Cyrenaica (Colosi 1923). Many specimens of this species collected in Istanbul (December 1922 and September 1923, H.C. Kellers) were examined by Holthuis in the U.S. National Museum in Washington, D.C.

***Palaemon (Palaeander) elegans* Rathke, 1837**

Leander squilla elegans Steinitz 1933, p. 146; Bodenheimer 1935, p. 466; Bodenheimer 1937, p. 281; Gottlieb 1953, p. 440.

Palaemon (Leander) elegans Carmin 1955, p. 3.

Numerous specimens from the Israel coast have been examined. The material originated from Atlit (13.VI.1929 and 15.IX.1940, leg. J. Carmin), Tantura (5.VII.1955, coll. Tel Aviv Institute of Natural Science), Caesarea (rockpools, 16, 30, and 31.III., 10, 16, and 19.VI., VIII. 1952, and 26.V.1954, leg. E. Gottlieb), and Tel Aviv (29.VI.1929, 3.I., 12.III., 8.IV., 9 and 26.V., 27.VI., 16.IX. 1930, 2.II. and 5.VI.1932, leg. J. Carmin), Ovigerous females (length 30 to 42 mm) were collected in March, July, and August. Steinitz (1933) mentioned the species from rock pools in Haifa Bay; Gottlieb (1953) reported it from rock pools near Caesarea, while Carmin (1955) stated it to be very abundant along the Mediterranean shore of Israel. This is certainly one of the most common littoral shrimps of the Israel coast, as it is on most of the Mediterranean shores.

The species has often been named *Leander* (or *Palaemon*) *squilla*, but as shown by Holthuis (1950, pp. 55-56), the correct name is *Palaemon elegans*.

Palaemon elegans inhabits the shores of the E Atlantic from Denmark and SW Norway to SW Africa; it occurs throughout the Mediterranean and in the Black Sea, while once it has been reported from the Red Sea. E Mediterranean records are: Peloponnesus, Greece (Guérin 1832), Phaleron Bay near Athens, Greece (Athanasopoulos 1917), Istanbul (= Constantinople) fishmarket (Ninni 1923, as *P. squilla*), near the entrance of the Bosphorus, near Princes Islands (= Kizil Adalar), near Bujuk-Cekmece, and at the southern coast of Marmara Island, Sea of Marmara (Ostroumoff 1896), Imros Island, N Aegean Sea (Forskall 1775), Cyclades (Stampalia) and Sporades (simi, Khos (=Coo), Rhodes and Karpathos (=Scarpanto) (Santucci 1928), ? Rhodes (Tortonese 1947), Cyprus (Heller 1863), Syria (Gruvel 1931), Saida (=Sidon), Lebanon (Monod 1931), Israel (Bodenheimer 1935, 1937, Carmin 1955), Haifa (Steinitz 1933), Caesarea, Israel (Gottlieb 1953), Port Said, Egypt (Balss 1927, Gurney 1927, 1927a, Fox 1927a), Lake Menzaleh near Port Said, and Lake Timsah, Suez Canal (Balss 1927, Gurney 1927, 1927a, Fox 1927a), near Alexandria, Egypt (Balss 1936), Derna, Cyrenaica (Colosi 1923).

Brachycarpus biunguiculatus (Lucas, 1846)

Four specimens were taken in rock pools near Caesarea (16.VII. and 23.X. 1952). These specimens are 29 to 46 mm long, the largest being an ovigerous female collected in October. Furthermore, 6 larvae in the *Retrocaris* stage were found in the stomach contents of a tuna, *Thunnus thynnus* (L.), which was collected off the Israel coast in November 1952.

Brachycarpus biunguiculatus evidently occurs throughout the Mediterranean, though it seems to be nowhere common. The previous Mediterranean records are all from the western part of this sea (Algeria, Gulf of Naples and Sicily). The species is practically circumtropic in its distribution, being known from the Mediterranean, W Africa, E America (the West Indies north to N Carolina and Bermuda), W America (Gulf of California south to Colombia and the Galapagos Islands), Polynesia, Ceylon and the Red Sea.

Subfamily PONTONIINAE

Palaemonella vestigialis Kemp, 1922

We examined material from the following Israel localities: off Nahariya (sample 1034), Haifa Bay (samples 71, 72, 74, 78, 84, 120, 121, 133, 169, 195, 281, 394, 396, 417, 709). The material was collected at depths between 18 and 46 m and consists of 22 specimens, their lengths varying between 4 and 13 mm. There are three ovigerous females (lengths 11 to 13 mm), which were collected in September and November (samples 121, 133, 709).

The larger part of the material agrees perfectly with Kemp's (1922, p. 123, text figures 1, 2, plate 3, figure 2) excellent description and figures of the species. Some of the specimens lacked part of the legs but in all remaining characters matched so well with the other material that they may be considered confidently as belonging to the present species.

Until now *Palaemonella vestigialis* Kemp was known only from the Indo-West Pacific area (Red Sea, Ceylon, the Adaman and Nicobar Islands, the Mergui and Malay Archipelagoes, Japan, the Marianas and the Hawaiian Islands). Kemp (1922) reported the species from the Gulf of Suez, and it seems most probable that it migrated through the Suez Canal to the Mediterranean.

Typton spongicola Costa, 1844

One damaged specimen was obtained from Haifa Bay (sample 231, depth 19 m).

Typton spongicola is known from the entire Mediterranean; it has frequently been reported from the W part of this sea, while Ostroumoff (1896, pp. 79, 92) mentioned material from the Sea of Marmara (off the entrance of the Bosphorus, and near the S coast of Marmara Island). Furthermore, the species has been recorded from the E Atlantic between the S coast of England and the Cape Verde Islands. It lives commensally in various kinds of sponges.

Family ALPHEIDAE

Athanas nitescens (Leach, 1814) (Figures 2, 3)

Several specimens have been collected in Haifa Bay (samples 71, 72, 84, 96, 132, 133, 231, 261, 281). The material was obtained from depths between 18 and 37 m. Of the 19 specimens collected, which had lengths of 4 to 10 mm, three are ovigerous females with a length of 9 mm. These ovigerous females were collected in August and September (samples 71, 261, 281).

Until recently the specimens of *Athanas* from the Atlantic coast of Europe and those found in the Mediterranean have generally been considered to belong to one species. In 1941 Mme. L. Nouvel pointed to differences found between two groups of Atlantic and one of Mediterranean *Athanas* specimens. Ten years later, Holthuis (1951, pp. 107-109) considered the Mediterranean form as specifically distinct from the Atlantic form, and employed the name *Athanas laevirhincus* (Risso) for the former. The main differences between the two "species" being:

(1) In *A. nitescens* the rostrum is straight and rather high (figure 2a), in *A. laevirhincus* it is slender and curved upwards (figure 2b).

(2) In *A. nitescens* the extra-corneal tooth is much stronger and more pointed than the infra-corneal (figure 2a), in *A. laevirhincus* the infra-corneal tooth is almost as strong as the extra-corneal, it is pointed and often reaches beyond the tip of the extra-corneal tooth (figure 2b).

(3) The tooth at the postero-lateral angle of the pleura of the fifth abdominal segment is far more pronounced in *A. laevirhincus* than in *A. nitescens* (figures 2d and 2c).

(4) In *A. nitescens* the antennular peduncle is rather broad, its second segment is about as long as, or shorter than, the third (figure 2e); in *A. laevirhincus* the peduncle of the antennula is more slender, the second segment being distinctly longer than the third (figure 2f).

(5) The fused part of the two rami of the outer antennular flagellum in *A. nitescens* is short and robust, consisting of 4 or 5 joints, which are distinctly broader than long (figure 2e), in *A. laevirhincus* this fused part is longer and more slender, consisting of up to 9 joints, which generally are longer than broad (figure 2f).

(6) The scaphocerite in *A. nitescens* is about twice as long as broad, with the outer margin straight and the final tooth hardly overreaching the lamella (figure 2g); in *A. laevirhincus* the scaphocerite is more slender, with the outer margin concave and the final tooth distinctly overreaching the lamella (figure 2h).

(7) In *A. nitescens* the penultimate joint of the third maxilliped is about half as long as the ultimate, in *A. laevirhincus* it is distinctly longer than half the ultimate joint (figure 2i).

(8) In the ovigerous females of *A. nitescens* the carpus of the first leg is about twice as long as broad (figure 2, j, k); in *A. laevirhincus* this carpus is up to four times as long as broad (figure 2, l, m).

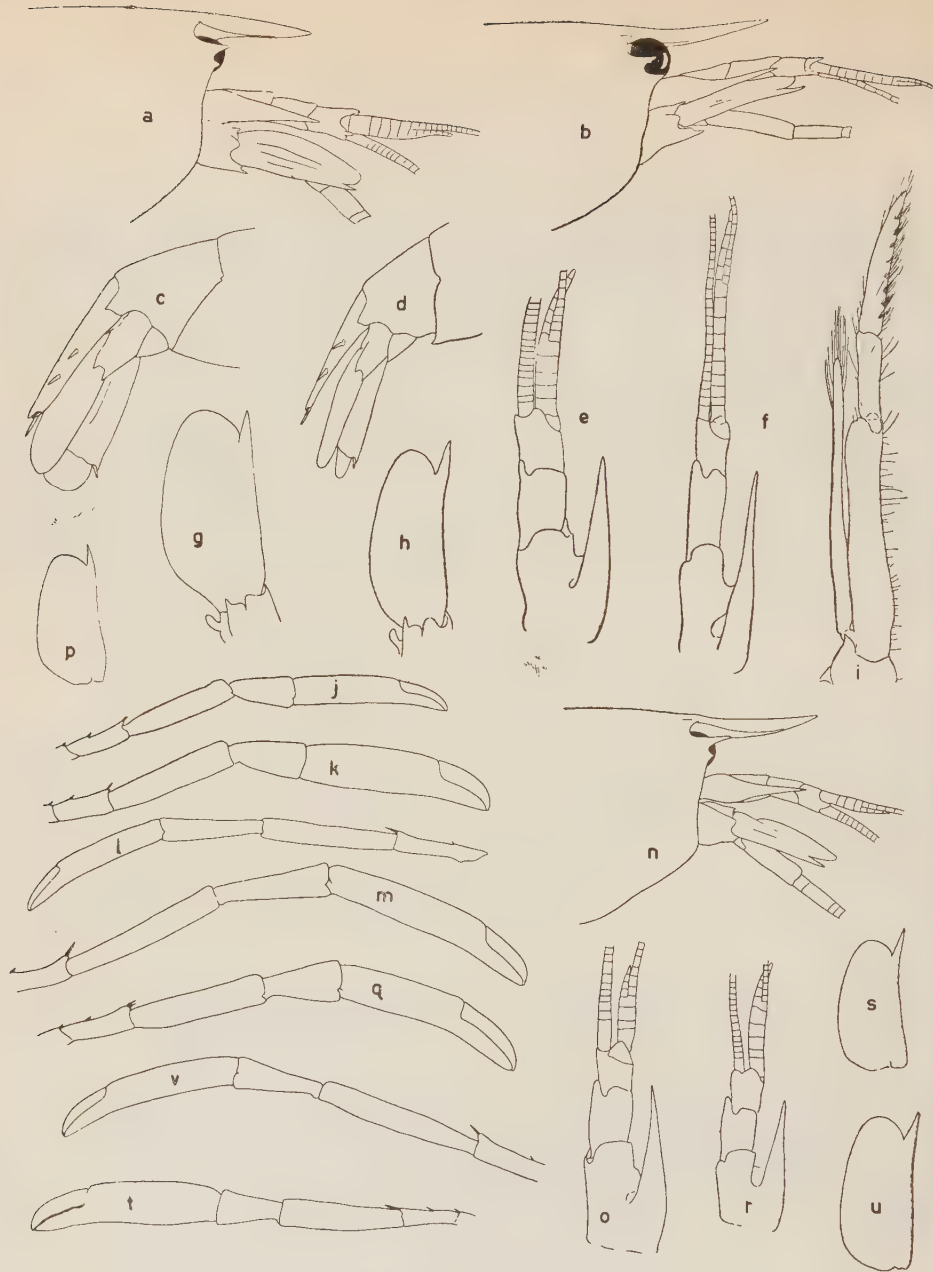


FIGURE 2.

Athanas nitescens (Leach). a, anterior part of body, ovigerous female from Plymouth, England ; b, the same, male from Cadaqués, NE Spain; c, posterior part of body, ovigerous female from Plymouth; d, the same, male from Cadaqués; e, antennula, specimen from Plymouth; f, the same, specimen from Cadaqués; g, scaphocerite, specimen from Plymouth; h, the same, specimen from Cadaqués; i, third maxilliped, specimen from Cadaqués; j, k, first pereopods, ovigerous females from Roscoff, W France; l, m, first pereopods, ovigerous females from Cadaqués; n, anterior part of body, female from Plymouth; o, antennula, same specimen; p, scaphocerite, specimen from Roscoff; q, first leg, ovigerous female from Plymouth; r, antennula, ovigerous female from Mallorca; s, scaphocerite, same specimen; t, first leg, same specimen; u, scaphocerite, ovigerous female from Cadaqués; v, first leg, same specimen. a-d, j-n, q, t, $\times 8$; e-i, p, r, s, u, v, $\times 12$.

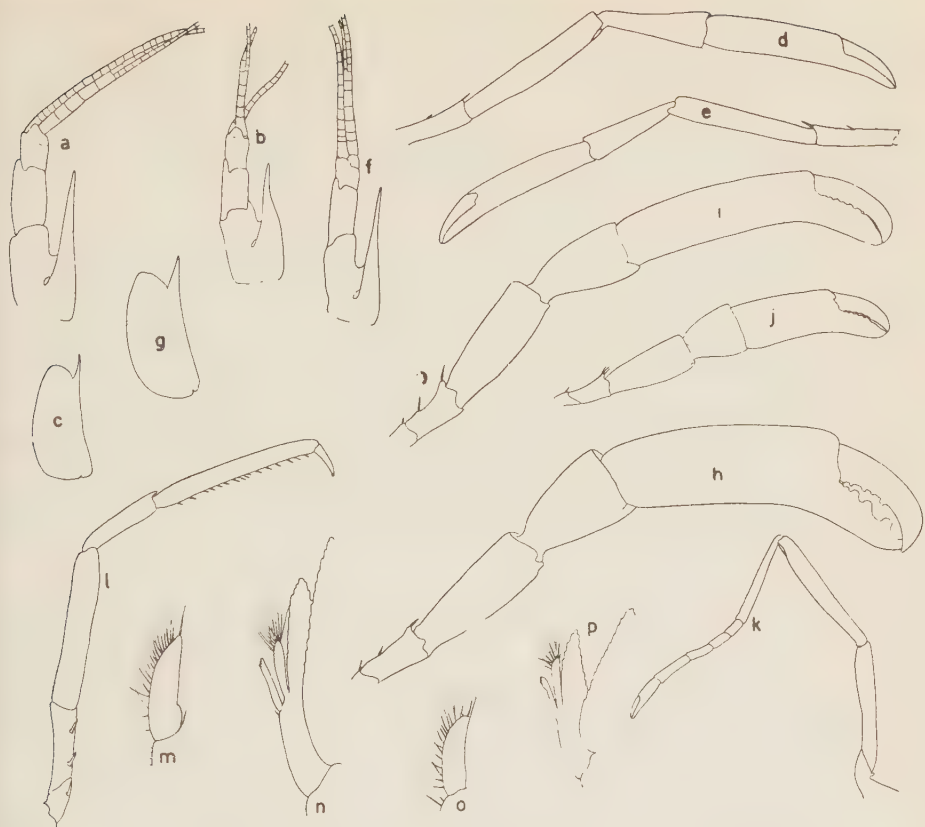


FIGURE 3.

Athanas nitescens (Leach). a, antennula, ovigerous female from Cadaqués, NE Spain; b, antennula, ovigerous female from Arenys, NE Spain; c, scaphocerite, same specimen; d, first leg, same specimen; e, first leg, ovigerous female from Cadaqués; f, antennula, same specimen; g, scaphocerite, same specimen; h, i, first legs, males from Cadaqués; j, first leg, male from Plymouth, England; k, second leg, male from Cadaqués; l, third leg, specimen from Cadaqués; m, endopod of first pleopod, male from Plymouth; n, endopod of second pleopod, same specimen; o, endopod of first pleopod, male from Cadaqués; p, endopod of second pleopod, same specimen. a-d, f, g, $\times 12$; e, k, l, $\times 8$; h-j, $\times 6$; m-p, $\times 20$.

The presence in Mediterranean *Athanas* material of specimens, which do not show all the characters mentioned above as being typical for *A. laevisrhincus*, induced us to re-investigate the problem of the status of that species. The present study of the variability of the various characters in both species of *Athanas* is based on material, which is far larger than that which formed the basis for the conclusions reached by Holthuis (1951). Apart from the Israel material mentioned above, we could study Mediterranean specimens from Italy (Naples), S France (Banyuls), NE Spain (several localities between Barcelona and the French border), the Balears (Mallorca and Ibiza), Spanish Morocco (Melilla), and Atlantic spe-

cimens from Spain (Vigo), France (Roscoff) and England (Plymouth). A large number of these specimens forms part of the private collection of Dr. R. Zariquiey Alvarez of Barcelona, to whom we want to express our deeply felt gratitude for the privilege of studying this most important material. The remaining specimens belong to the Rijksmuseum van Natuurlijke Historie in Leiden and the Zoological Museum in Amsterdam. In all, we could study 15 specimens from the Atlantic and about 200 from the Mediterranean.

In the Atlantic material examined, the shape of the rostrum shows some variation; it is not always straight, but sometimes more or less distinctly curved upwards (figure 2n). Also the tooth on the fifth abdominal segment is variable in size, being sometimes more distinct than figured here. In our material the other characters prove to be more or less constant. For comparison with the typical specimen shown in figures 2e, g, j, we reproduce here figures of the antennula (figure 2o), the scaphocerite (figure 2p), and the first leg (ovigerous female) (figure 2q) of those of our Atlantic specimens which in these features are closest to those of *A. laevirhincus*.

In the Mediterranean material the variation is far stronger. It is possible to recognize two forms: one which agrees almost perfectly with *A. laevirhincus* as characterized above, the other showing no appreciable difference from the Atlantic *A. nitescens*. As in the Atlantic specimens the shape of the rostrum and that of the tooth on the fifth abdominal pleura varies considerably in both forms, though in both an upwards curved rostrum is perhaps more frequently encountered than in the Atlantic form. The shape of the extra- and infra-corneal teeth also is variable in both Mediterranean forms and not too much importance can be attached to this character, which seems to vary independently from the other characters mentioned above. The characters dealt with in the above list under the numbers (4) to (8) seem to be the most important. In practically all ovigerous females with elongate carpi (i.e., carpi that are 3 to 4 times as long as broad) the antennula, scaphocerite and third maxilliped show the shape typical for *A. laevirhincus*, while nearly all ovigerous females with short carpi have the antennula, scaphocerite and third maxilliped of the *nitescens* type. However, these differences between the two types are not always constant, and intermediate specimens, which cannot be assigned with certainty to either of the two forms, do occur. Figures 2r, s, t, show the antennula, scaphocerite and first leg of an ovigerous female of the *nitescens* type from Mallorca, which does not differ from Atlantic specimens, except perhaps for the rather strongly concave external margin of the scaphocerite. However, an ovigerous female from Cadaqués, NE Spain, shows the scaphocerite (figure 2u) more like that of the Atlantic specimens, though the carpus of the first leg (figure 2v) of this specimen is somewhat more slender than of the ovigerous female from Mallorca, being nevertheless still less slender than that of a typical *A. laevirhincus*. The antennula (figure 3a) of the just mentioned female from Cadaqués is inter-

mediate in shape between that of the Mallorca female and a typical *A. laevirhincus*. In a lot from Arenys, NE Spain, the larger part of the specimens are quite typical *A. laevirhincus*, but some of them have the second segment of the antennular peduncle only slightly longer than the third (figure 3b). In these atypical specimens the fused joints of the outer antennular flagellum, though few in number, are rather elongate, while the scaphocerite (figure 3c) is sometimes of the *nitescens* type; the ovigerous females have the carpus somewhat less slender than in the typical *A. laevirhincus* (figure 3d). Another ovigerous female from Cadaqués resembles the figured specimen from Arenys in the shape of the carpus of the first leg (figure 3e), but the antennula (figure 3f) resembles more that of *A. laevirhincus*, though the scaphocerite is more of the *nitescens* type (figure 3g).

A careful comparison of our typical *laevirhincus* material with material from the Atlantic did not reveal any differentiating characters other than those mentioned above. The shape of the first legs of the male in both forms, apart perhaps from a slight difference in slenderness, proved to be the same. In both, two kinds of denticulation of the fingers of this chela were found: sometimes the fingers gape and show a few (1 to 4 or 5) very distinct and well marked teeth (figure 3h), sometimes they close over practically their entire length and have the cutting edge crenulate (figures 3i, j). Sometimes the left and right leg of one specimen are of the same, sometimes of different type; moreover the left and right first leg may or may not differ in size in both forms. The second legs in the *laevirhincus* material (figure 3k) are usually more slender than those of the other form, but otherwise they are similar. The second joint of the carpus, counted from the base of that segment, may be equal to, slightly longer or slightly shorter than, the third; this relation proved to be variable in both forms. In both forms the second pereopod shows a minute exopod, which is even smaller than the exopod of the first leg. Holthuis (1951) noted the exopod of the first, but not that of the second leg. The following legs (figure 3l) are similar in shape in both forms. In the shape of the first and second pleopods of the males of both forms (figures 3m, n, o, p) no constant differences could be found.

Our conclusion is that the *nitescens*-group of the genus *Athanas* in the Mediterranean is represented by two forms, but that these forms cannot be regarded as distinct species or subspecies, since they are connected by transitions and often occur together in the same locality.

Practically all our Israel material belongs to the *nitescens* type, only the specimen from sample 96 is of the *laevirhincus* type. In this specimen the antennal peduncle is slender with the third segment noticeably shorter than the second; the two rami of the external antennular flagellum are fused for seven rather elongate joints; in the third maxilliped the penultimate joint is distinctly more than half as long as the ultimate. The first legs are absent in this specimen, its rostrum is

only slightly curved and the extra-corneal tooth distinctly overreaches the infra-corneal.

Typical *laevirhincus* material has been examined from Arenys and from numerous localities near Cadaqués, both villages being situated on the Mediterranean coast of Spain north of Barcelona. The Mediterranean *nitescens* material examined by us originated from S France (Banyuls), NE Spain (Cadaqués, Rosas, Barcelona), the Balears (Mallorca, Ibiza), Spanish Morocco (Melilla), and Italy (Naples).

As far as the distribution is concerned the picture as we see it is the following *Athanas nitescens* (Leach) inhabits the E Atlantic between SW Norway and the Cape Verde Islands, including the entire Mediterranean. Apart from the typical form, which occurs throughout this range, there is a slender form, which may be named *Athanas nitescens* var. *laevirhincus* (Risso), which occurs in the entire Mediterranean, being known from the east coast (Israel) and the west coast (Spain) of this sea.

E Mediterranean records of the species are: Istanbul and near San Stefano, E part of the Sea of Marmara (Ostroumoff 1896), near Alexandria, Egypt (Bals: 1936).

***Athanas amazone* Holthuis, 1951 (Figure 4)**

Material was collected at: Haifa Bay (samples 286, 321, 334 and 373), off Natan-ya (sample 703), off Herzliya (samples 646, 835, 848), off Tel Aviv (sample 692), off Nabi Rubin (sample 840), off Nabi Yunis (samples 531, 626), off Ashkelon (samples 579, 579a), off Rafah (sample 547). The material was obtained at depths between 45 and 92 m. The total number of specimens taken is 18, their lengths varying between 4 and 10 mm. Among them are three ovigerous females (lengths 9 and 10 mm), which were collected in June, August and September (samples 531, 692, 703).

Only one of the present specimens is complete, all the others are lacking one or more legs. Still, the characters shown by them agree so well with those of the complete specimen and with the original description of *Athanas amazone*, that their specific identity is beyond any doubt.

A few additions to the original description can be given here. The rostrum in some specimens reaches only to the base of the second segment of the antennular peduncle; in most it is as long as in the type. The carapace in all the specimens examined shows a distinct transverse groove in the posterior half of the median region. The antennula may be slightly more slender than shown in the figure of the type. The number of fused joints of the two rami of the external antennular flagellum in the present specimens varies between 4 and 8. The free part of the shorter ramus consists of 1 to 3 joints. The scaphocerite in some specimens is somewhat more slender than in the type, and may have the external margin more concave. The last joint of the antennal peduncle, though usually as long as that of the

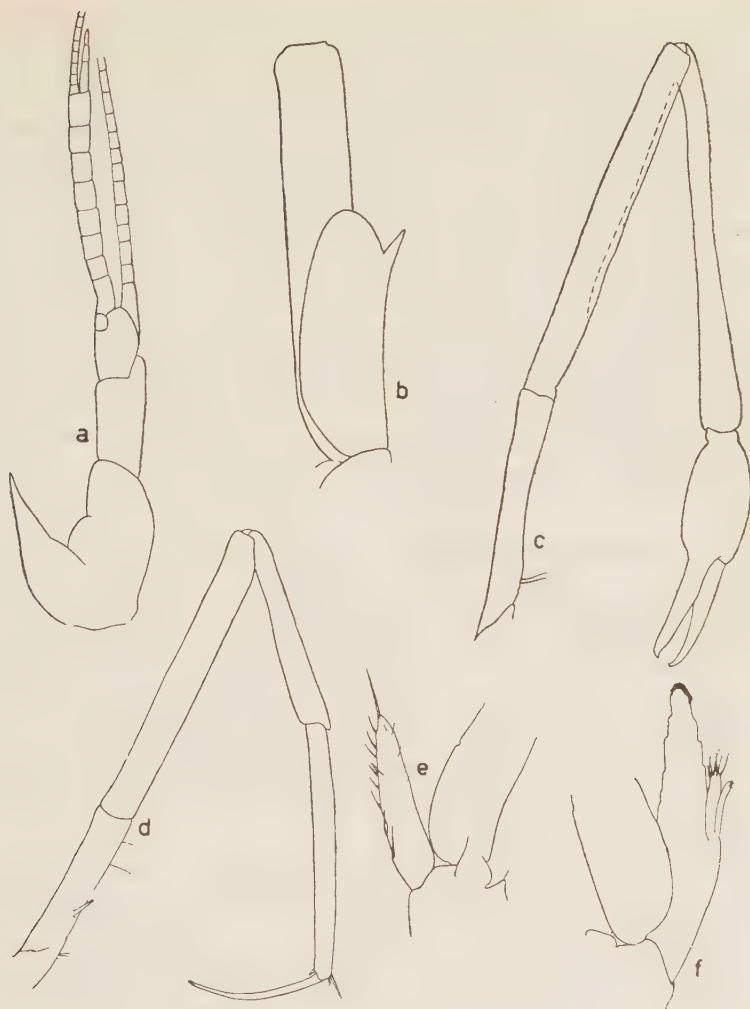


FIGURE 4.

Athanas amazone Holthuis, male from sample 646. a, antennula; b, scaphocerite; c, smaller first pereiopod; d, third pereiopod; e, endopod of first pleopod; f, endopod of second pleopod. a-d, $\times 25$; e, f, $\times 50$.

type specimen, sometimes is still longer, reaching with almost $2/5$ of its length beyond the scaphocerite. The only complete specimen, the ovigerous female of sample 531, has both first legs exactly like those of the type specimen, which likewise is an ovigerous female. The surface of the chela and the carpus of the larger leg shows scattered small tubercles. As in *A. nitescens*, the present species possesses a small exopod at the base of the first two pairs of legs, the exopod of the second pereiopod being far smaller than that of the first. The larger first leg is not present in any of the other specimens, though in two of the males the smaller leg is

still attached. The smaller first leg of the male strongly resembles that of the female. The following pereopods in both males and females closely resemble those of the type specimen. The endopod of the first pleopod of the male is small and of an elongate shape, ending in a strong single seta, while the outer margin bears some scattered stiff hairs and a few thinner hairs are placed near the inner margin. In the second pleopod of the male the appendix masculina only slightly overreaches the appendix interna and bears some stiff bristles at the top.

Until now *Athanas amazone* was known only from a single ovigerous female, which was collected off the coast of Nigeria on a muddy bottom at a depth of 52 m. The occurrence of this species in numerous localities off the Mediterranean coast of Israel is therefore, most unexpected. There is a possibility that the species also occurs in the intermediate region, but has been overlooked because of its small size and because of the fact that it lives at a depth (52 to 92 m) at which not very much collecting has been done so far.

***Automate branchialis* n. sp. (Figures 5, 6)**

Material has been examined from: off Nahariya (sample 637), Haifa Bay (samples 89, 119, 207, 231, 266, 281, 332, 335, 359, 373, 385), off Atlit (sample 731), off Caesarea (sample 641), off Kfar Vitkin (samples 617, 736), off Tel Aviv (sample 718), off Gaza (sample 537). The material was obtained from depths between 18 and 73 m. A total of 19 specimens, with lengths of 5 to 13 mm, is contained in these 18 samples. Only one ovigerous female (length 13 mm) is present; it was collected in November (sample 718). Holotype is the female of sample 537, the other specimens are paratypes.

Description — The anterior margin of the carapace is deeply concave in the median part behind the eyes and the antennulae. The rostrum is small but distinct, triangular and sharply pointed, but distinctly fails to reach as far forward as the lateral parts of the anterior margin of the carapace. The carapace itself is strongly compressed, smooth and bears no spines. The antero-lateral angles are rounded; the posterior margin at each side shows a distinct cardiac notch.

The pleurae of the first abdominal segment are truncated with the anterior angle broadly, the posterior narrowly, rounded. The pleurae of the other segments are rounded. The postero-lateral angle of the sixth segment is truncate with the distal margin slightly concave. The sixth segment is about as long as the fifth. The telson is triangular and regularly tapers posteriorly. In their proximal third the lateral margins of the telson show a distinct emargination, the telson being constricted there. The upper surface of the telson bears two pairs of spinules, the anterior of which is placed just behind the above mentioned constriction. The second pair lies about midway between the first pair and the posterior margin of the telson. This posterior margin shows a narrowly rounded median point, which at each side is flanked by two spines. The outer pair of spines is very small; the in-

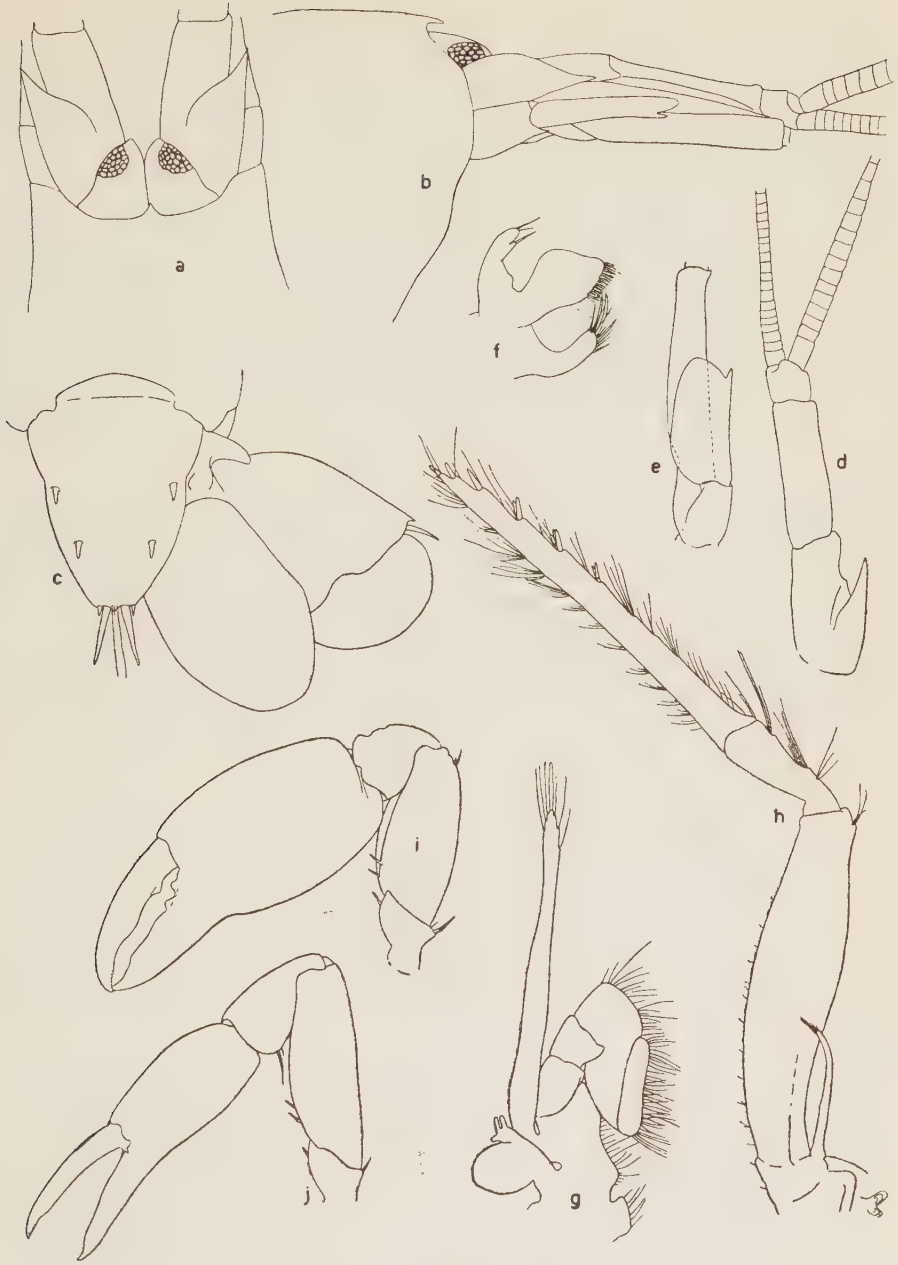


FIGURE 5.

Automate branchialis new species. a, anterior part of body in dorsal view; b, anterior part of body in lateral view; c, telson and right uropod; d, antennula; e, antenna; f, maxillula; g, second maxilliped; h, third maxilliped; i, larger first leg; j, smaller first leg. a, c, f, g, after specimen from sample 617; b, d, e, h, after specimen from sample 231; i, j, after specimen from sample 537a. a-c, $\times 24$; d, e, h-j, $\times 20$; f, g, $\times 32$.

ner spines are much longer and stronger, being more than four times as long as the outer. Two long and strong setae are placed between the inner spines.

The eyes are like those of *Callianassa*; they reach about to the end of the basal third of the basal segment of the antennular peduncle. In dorsal view they show a triangular shape, while their inner margins are in contact with one another over practically their entire length. The apex of the eyes is blunt. The cornea is oval in shape and is situated on the outer margin of the eye somewhat below the tip.

The antennular peduncle has the stylocerite rather broad, with the outer margin nearly straight, the inner strongly convex. Anteriorly the stylocerite ends in a sharp slender point, which almost reaches the end of the basal antennular segment. The inner surface of the basal segment does not show a ventral tooth. The second segment of the antennular peduncle is longer than the first and is about four times as long as the third. The external flagellum has about 10 to 15 basal joints thickened.

The antennal peduncle reaches slightly beyond the antennular. The scaphocerite attains about the middle of the last joint of the peduncle; it is twice as long as broad. The outer margin is slightly concave and ends in a distinct tooth, which is somewhat overreached by the lamella. A minute tooth is present in the lower external part of the antennal peduncle near the base of the scaphocerite.

The oral parts are similar to those figured by Holthuis (1951, figures 24, a-f) for *Automate evermanni* Rathbun. In the maxillula the palp, however, is distinctly



FIGURE 6.

Automate branchialis new species. a, larger first pereopod; b, second pereopod; c, third pereopod; d, fifth pereopod. a-c, after specimen from sample 617; d, after specimen from sample 231. a-d $\times 17$.

bilobed, the lower lobe bearing one, the upper two hairs. Furthermore the second maxilliped shows a small podobranch. The presence of this podobranch is the more remarkable since Coutière (1899, p. 285) stated that "la podobranchie, très réduite, insérée sur l'épipodite du 2e maxillipède... fait *constamment* défaut chez les Alphéidés." The third maxilliped reaches with part of the antepenultimate joint beyond the antennal peduncle. The last joint is about three times as long as the penultimate; it ends in a spine and bears some more spines in the distal half of the upper margin. The antepenultimate joint is slightly shorter than the ultimate, overreaching the exopod with more than half its length. With the exception of the presence of a podobranch on the second maxilliped, the branchial formula of the present species is identical with that given by Holthuis (1951, p. 118) for *A. evermanni*.

The first pereipods are unequal, at least they are so in the female of sample 537, the only specimen which possesses both first pereipods. In two other specimens, probably males, only the larger first leg is present. This larger first leg of the (supposed) male is very heavy. The fingers are about as long as the palm, they are curved and gaping. Both fingers have the cutting edges emarginate in the middle. Proximally of the emargination of the cutting edge of the dactylus, a distinct, though blunt, tooth is present, while just distally of the emargination there is a low and indistinct tooth. Some minute, but sharp crenulations are visible on the edge just before the tip of the dactylus. The cutting edge of the fixed finger has two blunt teeth on either side of its median emargination, the two proximal being high and distinct, the two distal indistinct and low; here too the cutting edge shows minute crenulations just before the tip of the finger. The palm is somewhat longer than high. Its longitudinal axis makes an angle with that of the fixed finger, which is directed more downwards. The lower margin of the palm is somewhat convex. When the surface of the palm is dried and examined under strong magnification it proves to be finely shagreened; the surface of the fingers is entirely smooth. The carpus is very short; it measures distinctly less than half the length of the palm. It is constricted a short distance behind the anterior margin. The merus measures about $3/4$ of the length of the palm; near its upper anterior end a strong spine-like seta is present, while in the proximal part of the inner ventral margin two similar setae may be observed. The ischium is short and in the upper and lower part of the anterior margin it bears a strong seta. The larger leg of the female is similar to that of the male, but is more slender. The gap between the fingers is less distinct, as are also the distal teeth of the cutting edges. The smaller leg of the female is still more slender. Apart from the distal crenulations no teeth are visible here on the cutting edges. The fingers are about as long as the palm, which is almost twice as long as high. The carpus is about $2/3$ as long as the palm. The merus is 1.5 times as long as the fingers. The second legs are very long and slender and they reach with the merus beyond the scaphocerite. The chela is elon-

gate with the fingers slightly shorter than the palm. The carpus is subdivided into five joints, the distal two of which are of about the same length; the third joint is almost 1.5 times as long as the second, while the fourth is about as long as the second and third combined; the fifth (proximal) joint is about as long as either the first or second. The merus is about $2/3$ as long as the carpus. The ischium somewhat shorter than the merus. The third pereopod reaches with the larger part of the propodus beyond the antennal peduncle. The dactylus is simple and curved, measuring somewhat less than half the length of the propodus. The latter joint tapers slightly distally, its posterior margin bears no spines except for one at the extreme distal end near the base of the dactylus; many hairs are present. The carpus is about $3/4$ of the length of the propodus, it gradually narrows proximally. The merus measures $4/3$ of the length of the propodus and is distinctly broader than the other joints. The ischium is short and bears a movable spine near the posterior margin. The fourth leg reaches to about the end of the antennal peduncle; its shape strongly resembles that of the third, but is somewhat more slender. The fifth leg reaches about to the end of the scaphocerite. The dactylus is like that of the third leg. The propodus, which is somewhat more than twice as long as the dactylus, does not broaden proximally. In its distal part the posterior margin bears some transverse rows of short hairs, while a row of about 7 strong spines is placed along the inner side of this margin. The carpus measures $2/3$ of the length of the propodus. The merus is somewhat longer than the propodus. The ischium is short and bears a movable spine near the posterior margin.

In most of the specimens the pleopods are lost, only in the female of sample 537 is the larger part of the pleopods still attached. They prove to be of the normal type. The uropods have the protopod provided with a blunt, somewhat truncated, posteriorly directed process, which overhangs the base of the exopod. The endopod is oval in shape. The exopod has the outer margin ending in a small but sharp tooth, which at its inner side bears a movable spine. A distinct diaeresis is present.

The eggs are 0.2 to 0.3 mm in diameter.

Until now ten species of the genus *Automate* De Man 1888, have been described. Two of these (*A. rugosa* Coutière and *A. baightae* Boone) were reported from the W coast of tropical America, while three originate from the tropical and subtropical Atlantic (*A. kingsleyi* Hay, *A. evermanni* Rathbun, *A. talismani* Coutière), namely from the E coast of the U.S.A., from the West Indies and from tropical W Africa. The remaining five species (*A. dolichognatha* De Man, *A. anacanthopus* De Man, *A. gardineri* Coutière, *A. salomoni* Coutière, and *A. johnsoni* Chace) are found in the Indo-West Pacific region.

In the sharply pointed rostrum the present new species differs from *A. gardineri*, *A. baightae* and *A. talismani*, which have a bluntly rounded rostrum. From *A. salomoni* it may immediately be distinguished by the shortness of the rostrum; in

the latter species, namely, the rostrum reaches beyond the lateral parts of the anterior margin of the carapace. The size and the shape of the rostrum of *A. branchialis* is very similar to that of the six other species. In the absence of spines along the posterior margin of the propodus of the third and fourth legs *A. branchialis* differs from *A. johnsoni* and from *A. dolichognatha*, the type species of the genus, but it resembles in this respect *A. evermanni* and *A. anacanthopus*; in the other two species this character has not been described sufficiently. The shape of the scaphocerite proves to be a very valuable character: in *A. kingsleyi*, *A. anacanthopus*, *A. evermanni*, *A. johnsoni* and *A. dolichognatha* the final tooth overreaches the lamella, whereas in the new species the lamella reaches beyond the final tooth. *A. rugosa*, which was only quite summarily described, differs from *A. branchialis* in the shape of the large chela which has the upper and lower margins of the palm rugose, bears groups of oblique ridges on the external surface of the palm, and possesses fewer teeth on the cutting edges of the fingers,

Little can be said about the origin of the present species. The fact that no species of *Automate* has ever been reported from the Mediterranean is an argument in favour of the supposition that *A. branchialis* actually is an Indo-West Pacific species, which entered the Mediterranean through the Suez Canal. On the other hand, the fact that until now relatively little attention has been paid to the smaller bottom dwelling Crustacea of the Mediterranean, does not exclude the possibility that the new species is a true Mediterranean form. It is up to future workers to solve this problem.

***Salmoneus ? jarli* (Holthuis, 1951) (Figure 7)**

A single specimen with a length of 8 mm was collected off Nabi Rubin (sample 830, depth 90 m). Unfortunately, this specimen is severely damaged lacking all its legs. Its identity cannot, therefore, be established with certainty. Since the second pleopods are also damaged it is impossible even to state whether the specimen is a male or a female.

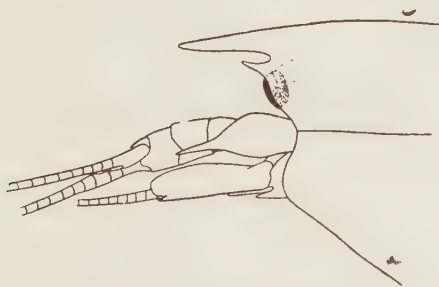


FIGURE 7.

Salmones ? jarli (Holthuis), anterior part of body of the specimen from sample 830. $\times 30$.

The posterior margin of the telson is straight and does not show a median emargination. This feature excludes the possibility that the specimen belongs to any of the known Indo-West Pacific species of *Salmoneus*, since in those a distinct median emargination of the posterior margin of the telson is constantly present. In the straight posterior margin of the telson the present specimen strongly resembles *Salomoneus arubae* (Schmitt) from the Netherlands West Indies and *S. jarli* (Holthuis) from W Africa. Of the two other Atlantic species of the present genus, *S. trigona* (Rathbun) from Porto Rico and *S. ortmanni* (Rankin) from Bermuda and the Bahamas, the exact shape of the posterior margin of the telson is unknown. The Israel specimen differs from *S. trigona* in having no other carinae on the carapace than the median dorsal carina, while it may be distinguished from *S. arubae* by having the supra-corneal teeth more distinct and the scaphocerite far more slender with the outer margin about straight. In the shape of the scaphocerite the present specimen strongly resembles *S. jarli* and differs from *S. ortmanni*. In the other characters it also shows very close resemblance to *Salmoneus jarli* and therefore probably belongs to that species. The few differences found between our specimen and Holthuis' (1951) original description are the following: The rostrum reaches about to the end, instead of about to the middle, of the second segment of the antennular peduncle. The supra-corneal teeth are slightly longer. The dorsal carina is less distinct. Between the two inner of the four posterior spines of the telson only two hairs are visible. The external antennular flagellum has the two rami fused for one joint, while the free part of the shorter ramus consists of two joints only.

Since these differences are so few and for the larger part are only gradual, it is well possible that they will prove to fall within the range of variation of these characters in *S. jarli*. Since *S. jarli* is only known from the single male type specimen and as our Israel specimen may be a female, very little can be said about the definite identity of the latter, especially since the important characters provided by the pereopods are not known from the Israel specimen. Therefore this specimen is assigned provisionally to *S. jarli*. It is hoped that additional material may ultimately solve the identity of the Israel form.

Salmoneus jarli (Holthuis), which originally was described as *Jousseauimea jarli*, is known from a single specimen collected off Nigeria, 4° 12'N, 7° 05'E, at a depth of 19 m on a bottom of clayish mud. The occurrence of this (or a very closely related) species off the Israel coast, has a close parallel in the discovery of the W African *Athanas amazone* in Israel waters.

Alpheus glaber (Olivi, 1792)

Alpheus ruber Gottlieb 1953, p. 440; Wirszubski 1953, p. 17

Material has been examined from: off Nahariya (sample 1063), Haifa Bay (samples 225, 287), off Caesarea (samples 565, 565b, 643, 700), off Kfar Vitkin

(samples 618, 619), off Natanya (sample 689), off Herzliya (samples 568, 645, 766), off Tel Aviv (samples 692, 713, 718), off Nabi Rubin (samples 573, 574b, 576a, 649, 741, 840), off Nabi Yunis (samples 535, 625, 626, 627), off Gaza (samples 540, 631). The present material was obtained from depths between 38 and 140 m and consists of 30 specimens from 28 samples. The lengths of the specimens vary between 10 and 22mm; no ovigerous females are present. A large part of the material is immature.

Alpheus glaber, which is often incorrectly named *Alpheus ruber* H. Milne Edwards, occurs from the S coast of England and Ireland southwards to the Mediterranean. E Mediterranean records are : Sea of Marmara, 41° 07'N 29° 05'E, 40° 54'N 28° 53'E, and 40° 45'N 27° 43'E; N Aegean Sea, 40° 02'N 25° 55'E, and 38° 49'N 25° 09'E; Gulf of Aigina, E of Korinthos, 37° 52'N 23° 09'E, and 37° 51'N 23° 14'E; W of Crete, 35° 50'N 21° 30'E; SE of Crete, 33° 20'N 27° 30' E (Stephensen 1923), Sporades, 37° 37' N 26° 58' E (Adensamer 1898), Israel (Gottlieb 1953, Wirszubski 1953), near Alexandria, Egypt (Balss 1936).

***Alpheus dentipes* Guérin, 1832**

Material has been examined from: Haifa Bay (samples 72, 84, 94, 121, 231, 298, 390, 709), off Caesarea (sample 682). The species is represented in these 9 samples by 18 specimens, which have lengths varying between 6 and 18 mm. The material was obtained from depths between 18 and 72 m. Seven of the specimens are ovigerous females (lengths 12 to 17 mm); they were collected in April, June, August and September (samples 231, 298, 390, 682).

Alpheus dentipes is known to inhabit the E Atlantic between the Portuguese coast and the Gulf of Guinea; it is furthermore found throughout the Mediterranean and in the Black Sea. E Mediterranean records are : Sapienza and Cape Tainaron, S Greece (Guérin 1832), near San Stefano, E part of Sea of Marmara (Ostroumoff 1896), near Alexandria, Egypt (Balss 1936). In the collection of the Academy of Natural Sciences at Philadelphia, U.S.A., two dry specimens of this species, said to be the types of Guérin, could be examined recently (May 1957). One specimen was definitely *Alpheus dentipes*, the other was too much damaged for certain identification. The specimens were labelled "*Alpheus dentipes* Guérin. Type. Nice. T. B. Wilson. Guérin coll. 300". In an old catalogue in the possession of the Academy an entry stated that this material came from Nice and Greece so that one of the specimens may actually be the type of the species.

***Alpheus audouini* Coutière, 1905**

Alpheus spec. Gottlieb 1953, p. 440.

Material from the following localities was examined : Haifa harbour (1. XII. 1954, coll. Institute of Natural Science, Oranim), Caesarea (rock pools, 16.VII and 14. X. 1952, V. 1954), Herzliya (littoral area, 15. VIII. 1951, coll. Tel Aviv

Institute of Natural Science), Bat Yam (coll. Tel Aviv Institute of Natural Science). This material consists of seven specimens, the lengths of which vary between 20 and 43 mm. Two among these are ovigerous females (lengths 36 and 42 mm), one of which was collected in October, whilst the collecting date of the other is unknown.

As De Man (1911, p. 414) already pointed out, the differences between *Alpheus audouini* Coutière, *A. edwardsii* Audouin and *A. chiragricus* H. Milne Edwards are very slight and may prove to be insufficiently constant to justify the specific separation of these three forms. The material at our disposal is too small to enable us to form a well founded opinion on this question. All the Israel specimens have the lobes on the upper and lower margin of the propodus of the large chela bluntly rounded, while the other characters shown by these specimens also agree well with Coutière's (1905, p. 911, plate 87 figure 52) description and figures of the species.

Gottlieb (1953) reported specimens of this species, which he indicated as *Alpheus* sp., from rock pools in the vicinity of Caesarea.

Alpheus audouini inhabits the entire Indo-West Pacific area, being reported by Coutière (1905) from the Red Sea to New Zealand and Hawaii. Banner (1953) however, doubts whether the species actually occurs in Hawaii, and Coutière's statement may therefore have been too sweeping. The species evidently entered the E. Mediterranean by way of the Suez Canal. Balss (1927), Fox (1927a), and Gurney (1927a) reported it from Port Said and the Gulf of Suez, while Tortonese (1947b, 1952) mentioned it from the Suez Canal (Lake Timsah).

***Alpheus inopinatus* n. sp. (Figures 8, 9)**

Material was examined from the following Israel localities: Tantura (5. VII. 1955, coll. Tel Aviv Institute of Natural Science, 1 ovigerous female of 24 mm), Caesarea (rock pool, VIII. 1952, 1 male of 27 mm), Herzliya (shore, littoral area, 15.VIII.1951, coll. Tel Aviv Institute of Natural Science, two males of 23 and 28 mm, one ovigerous female of 24 mm), Bat Yam (coll. Tel Aviv Institute of Natural Science, one ovigerous female of 27 mm).

The rostrum is short and sharply pointed, and it fails to reach the end of the basal segment of the antennular peduncle. Posteriorly it continues in a distinct but not very sharp carina which fades out slightly behind the base of the eyes. This carina is separated from the ocular hoods by distinct grooves, the lateral and posterior borders of which are not sharply demarcated. A few inconspicuous lateral hairs may be visible on the rostrum, but they are often absent. The ocular hoods are well pronounced, their anterior margin is rounded and no ocular spines are present. In the posterior margin of the carapace there is a distinct cardiac notch. The carapace and the abdomen are entirely smooth and naked.

The pleurae of the first four abdominal segments are broadly, those of the fifth rectangularly rounded. The sixth abdominal segment has the pleura narrowly truncated and the postero-lateral angle broadly rounded. The telson is quadrangular, being distinctly longer than broad. The posterior margin is shorter than the anterior. There are two pairs of dorsal spines on the telson; the first pair is placed somewhat before the middle of the telson, the second pair is situated slightly closer to the anterior pair than to the posterior margin of the telson. This latter margin is slightly convex; on both of the extreme lateral portions 2 short spines are present, the outer one being smaller than the inner; in the median part of the posterior margin about 10 spinules are present; furthermore, a fringe of long hairs runs over the full extent of the margin.

The eyes are pigmented and entirely concealed under the ocular hoods.

The basal segment of the antennular peduncle has the stylocerite broadly oval, ending in a sharp point, which reaches to, or almost to, the end of the segment. The second segment is slightly shorter than the first, while the third measures about $5/8$ of the length of the second.

The scaphocerite is about 4 times as long as wide. It reaches just beyond the end of the antennular peduncle. The outer margin shows a distinct concavity in the basal part, the distal part is straight. The final tooth is very strong, being as wide as or wider than the adjoining part of the lamella. The latter is very narrow and fails by far to reach the end of the final tooth. The antennal peduncle sometimes distinctly overreaches the scaphocerite but sometimes just fails to reach the end of it. A small but distinct spine is present on the antennal peduncle, below the base of the scaphocerite.

The oral parts are of the usual shape. The first maxilliped has the palp two-jointed; the distal joint is elongate, but is far shorter than the proximal. The epipod is about triangular with the lower angle strongly produced. The epipod of the 2nd maxilliped is also triangular, but it has the upper angle produced. The third maxilliped reaches with part of the last segment beyond the antennal peduncle. This last segment is about twice as long as the penultimate, and is somewhat shorter than the antepenultimate segment. The exopod reaches beyond the end of the antepenultimate segment. An epipod, an arthrobranch, and a rudimental pleurobranch are present. Apart from the rudimental pleurobranch of the third maxilliped the branchial formula is normal:

	Maxillipeds			Pereiopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	—	—	1 rud.	1	1	1	1	1
Arthrobranchs	—	—	1	—	—	—	—	—
Podobranchs	—	—	—	—	—	—	—	—
Epipods	1	1	1	1	1	1	1	—
Exopods	1	1	1	—	—	—	—	—



FIGURE 8.

Alpheus inopinatus new species, holotype. a, anterior part of body in dorsal view; b, anterior part of body in lateral view; c, telson and right uropod; d, third maxilliped; e, larger first leg, inside; f, larger first chela, outside. a-f, $\times 7$.

The first pereopods reach with the chela beyond the antennal peduncle. The larger leg has the upper margin of the dactylus evenly rounded, forming almost a semicircle. The ventral margin bears a very strong blunt tooth, which fits in a cavity on the cutting edge of the fixed finger. The palm is somewhat less than twice as long as the fingers. Both the upper and the lower margin are provided with a distinct broad and blunt incision. The lower incision is rather deeper than the upper, and continues on the outer surface as an oblique deep groove. The palm shows a broadly triangular impression on the inner surface just below the upper incision; the outer surface has a similar depressed area, which, however, is more quadrangular in outline. A blunt tooth is present on the inner surface of the palm near the base of the dactylus; this tooth is rather indistinct in the female. The carpus is short and cup-shaped; the anterior margin sometimes shows a lobe on the inner side, but often this lobe is extremely inconspicuous or even entirely absent. The merus is about half as long as the palm. The lower margins of the merus bear no spines and end anteriorly in a rounded lobe. The smaller first leg in the male has the dactylus *Balaeniceps*-shaped: both on the inner and the outer surface there is an oblique row of closely set hairs, placed on a distinct ridge, which in its basal part overhangs the cutting edges of the fingers. The fingers are about as long as the palm; their cutting edges are unarmed. The palm is more slender than in the large leg. The dorsal and ventral incisions, though less pronounced than in the larger leg, are still very distinct. Here, too, is a triangular depressed area on the inner surface of the palm below the dorsal incision. A distinct, rather sharply pointed tooth is present on the inner surface near the base of the dactylus. The carpus is as in the large leg, but the anterior margin on its inner side shows a distinct rounded lobe. The merus resembles that of the large leg and is about $2/3$ of the length of the palm. In the female the smaller leg differs conspicuously from that of the male by the absence of the hairy ridges on the dactylus; the incisions on the palm are less distinct here, but still well noticeable. The merus is as long as the palm. The second legs reach with about the carpus (sometimes less, sometimes more) beyond the antennal peduncle. The fingers are slightly longer than the palm. The carpus is almost three times as long as the chela and is subdivided into five segments, the proximal of which is slightly longer than the second; the third and the fourth are subequal in length, together being somewhat shorter than the second and slightly longer than the fifth segment. The merus is about as long as the first and second segments of the carpus together, and about as long as the ischium. The third leg reaches with part of the propodus beyond the antennal peduncle. The dactylus is simple and measures about $2/5$ of the length of the propodus. The latter segment has some eight strong spines placed on the lower margin with a few smaller spines in between; also the anterior margin of the propodus bears some spines which are placed in the lower portion. The carpus is about 0.7 times the length of the propodus. The merus is unarmed; it is broader and somewhat longer than the propodus. The ischium is short and bears a movable spine on the lower



FIGURE 9.

Alpheus inopinatus n. sp. a, smaller first leg of holotype, inside; b, smaller first leg of holotype, outside; c, smaller first leg of female paratype, outside; d, second leg, holotype; e, third leg, holotype; f, fifth leg, holotype; g, first pleopod, holotype; h, second pleopod, holotype. a-h, $\times 7$.

margin. The fourth leg is very similar to the third. The fifth leg, however, differs considerably from the two preceding appendages, being more slender. The shape of the dactylus and its relation to the propodus are as in the third leg. The propodus itself, however, shows only few (3 to 6) spines on the lower margin, while these spines are far more slender. Furthermore, there are numerous transverse rows of hairs placed close together in the posterior distal portion of the propodus. The carpus is only slightly shorter than the propodus, while the merus is somewhat longer than that segment. The ischium is unarmed.

In both the males and the females the endopod of the first pleopod is small and oval in shape without any appendages but with a fringe of hairs. The second pleopod of the male has the appendix masculina slightly longer than the appendix interna; numerous hairs are implanted on the appendix masculina. The protopodite of the uropods ends dorsally in two strongly pointed teeth. The endopod is oval in shape, the exopod is more quadrangular. The outer margin of the exopod ends in a distinct tooth, to the inside of which there is an uncoloured strong spine.

The eggs are numerous and small, having a diameter of 0.5 to 0.7 mm.

Types. The larger male from Herzliya is the holotype, the other specimens are paratypes. The holotype and three paratypes are preserved in the Rijksmuseum van Natuurlijke Historie, Leiden, while the Haifa Sea Fisheries Research Station and the Tel Aviv Institute of Natural Science possess the other paratypes.

The present new species belongs to the *edwardsii* group of the genus *Alpheus*. It proves to be related most closely to *A. euphrosyne* De Man, *A. microrhynchus* De Man and *A. paludicola* Kemp. Like these species it differs from the other Mediterranean species of this group (*A. audouini* Coutière and *A. crassimanus* Heller) by lacking the anterior tooth on the inner ventral margin of the merus of the chelipeds. *Alpheus inopinatus* differs from its three closest allies in the shape of the scaphocerite, which in the latter forms is very broad, with the lamella practically attaining the tip of the final tooth or reaching beyond it. It differs furthermore from *A. microrhynchus* and *A. paludicola* by having the rostrum much longer, by the far more robust smaller cheliped of the male and by the far smaller eggs (which in *A. paludicola* are 1.4 mm in diameter). In *A. microrhynchus*, moreover, there are no incisions on either the upper or lower margins of the palm of the smaller chela. In *A. euphrosyne* De Man the present species finds its closest relative. In this species, apart from the difference in the shape of the scaphocerite, the following distinguishing features may be noted: (1) the rostrum is not continued posteriorly as a carina; (2) the spine on the antennal peduncle is absent; (3) the smaller first leg is distinctly more slender in both male and female, while in the female, moreover, no incisions are visible on the upper and lower margins of the palm; (4) the third leg is more slender and has only about three slender spines on the lower margin of the propodus. Unfortunately, the large cheliped of *A. euphrosyne* has not been figured.

In view of the fact that no species of *Alpheus* belonging to the *edwardsii*-group are original inhabitants of the Mediterranean (*A. audouini* and *A. crassimanus* being Indo-West Pacific forms which evidently have migrated through the Suez Canal) and that the species is too large to be easily overlooked, it seems very probable that, like the last mentioned two species, it is an immigrant from the Red Sea.

***Synalpheus gambarelloides* (Nardo, 1847)**

Material has been collected at : off Nahariya (sample 504), Haifa Bay (samples 98, 120, 121, 135, 155, 169, 245, 257, 273, 317). The material was obtained at depths between 22 and 46 m. A total of 37 specimens was collected, their lengths varying between 6 and 19 mm. The six ovigerous females (lengths 13 to 19 mm) were collected in July and August (samples 245 and 257).

This species, which is better known as *Synalpheus laevimanus* (Heller 1862), was first reported upon by Olivi (1792, p. 51, plate 3, figure 5), who referred to it as *Cancer glaber* var., considering it to be a variety of *Alpheus glaber* (Olivi). Nardo (1847, p. 6) was the first to give the species a name, when he discussed an old manuscript by Abbé S. Chiereghin in which a number of new species was described. Nardo recognized the species which Chiereghin had named *Cancer gambarelloides* to be new, named it *Alpheus gambarelloides* and gave a diagnosis of it. In a later publication Nardo (1869, p. 107, plate 3, figure 3) gave a more extensive discussion and a figure of the species, which leaves not the least doubt as to its identity with *Synalpheus laevimanus*, especially the shape of the large chela being characteristic. The species was again described as new when Hope (1851, p. 43) published his *Alpheus spin-cigerus*. The name *Alpheus laevimanus* which Heller gave to the species 11 years later, is thus twice preoccupied and cannot be used any more. Coutière (1899, pp. 11-12) identified *Cryptophthalmus costa* Prestandrea (1838) and *Cryptophthalmus ventricosus* Costa (1836-1847) with the present species, but he is mistaken since *C. costa* is undoubtedly identical with *Alpheus dentipes* Guérin, 1832, while *C. ventricosus* is a synonym of *Alpheus macrocheles* (Hailstone, 1835).

Synalpheus gambarelloides is known from the entire Mediterranean. The E Mediterranean records are : Capo Bove, Rhodes (Santucci 1928), near Alexandria, Egypt (Balss 1936).

Family OGYRIDIDAE

***Ogyrides mjobergi* (Balss, 1921) (Figure 10)**

Specimens have been collected : off Atlit (sample 693), off Caesarea (sample 639), off Nabi Yunis (sample 624). The material was collected at depths between 15 and 18 m. Each sample contains only one specimen, none of which is ovigerous; their lengths vary between 4 and 8 mm.

The specimens show such a strong resemblance to *Ogyrides mjobergi* that they have to be referred to that species. The rostrum is short, dorsoventrally depressed and triangular. It reaches about as far forwards as the lateral parts of the anterior margin of the carapace. In its mid-dorsal line the carapace bears three spines. In the largest specimen the proximal of these spines is placed in the proximal part of the distal third of the carapace, the distal spine being placed about halfway between the proximal spine and the tip of the rostrum, exactly like the situation shown in Balss' (1921) figure. In the second largest specimen the three spines are placed closer to the tip of the rostrum. A very small antennal spine is present on the anterior margin of the carapace, being similar in size and position to the antennal spine of *Ogyrides varispina* Holthuis (cf. Holthuis 1951, p. 119, figure 25). This spine is not shown in Balss' figure of *O. mjobergi*; it has probably been overlooked there because of its small size.

The telson is about as long as the sixth abdominal segment. It is triangular in shape. The lateral margins show a triangular lateral projection slightly before their middle. The posterior margin is strongly convex. It bears two pairs of spines which are placed in its extreme lateral parts. The outer pair is very short; the inner pair is much longer, but still fails to reach the posterior tip of the telson. The upper surface of the telson bears two pairs of spinules, both of which are placed distinctly behind the expansion of the lateral margins. As in *Ogyrides striaticauda* Kemp and *O. varispina* Holthuis a few short ridges are placed in the anterior half of the lower surface of the telson, near its lateral margins.

The eyes agree very well with Balss' figure; they reach slightly beyond the end of the antennular peduncle.

The stylocerite ends in two slender spines, the outer of which reaches to about $3/4$ of the length of the basal segment of the antennular peduncle, the inner spine being shorter. The second segment of the peduncle is about $5/8$ as long as the basal and 1.5 times as long as the distal segment.

The scaphocerite strongly resembles Balss' figure of that appendage. The antennal peduncle is shorter than in Balss' specimen and fails to reach the end of the antennular peduncle.

The third maxilliped reaches with the ultimate two joints beyond the scaphocerite. The last joint is less than half as long as the penultimate, and $5/8$ as long as the antepenultimate. The exopod reaches $2/3$ of the length of the antepenultimate joint.

The first leg is short and reaches about to the end of the eyes. It has the fingers slightly longer than the palm. The carpus is only slightly longer than the chela, which is about as long as the merus. The second pereopod reaches with the chela beyond the eyes. The fingers are distinctly longer than the palm and gape slightly. The carpus is about 1.5 times as long as the chela. It is subdivided into four joints,

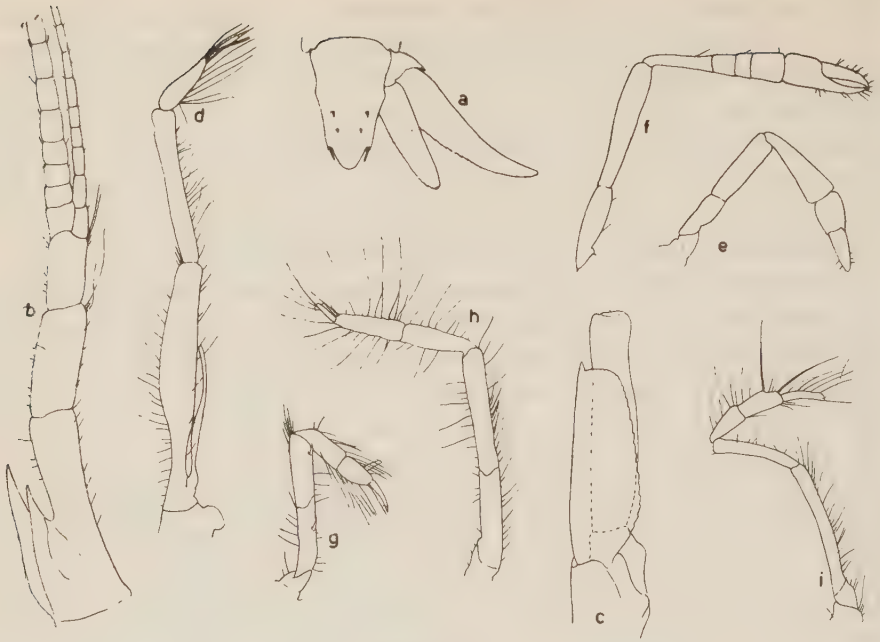


FIGURE 10.

Ogyrides mjobergi (Balss). a, telson and first uropod; b, antennula; c, antenna; d, third maxilliped; e, first pereopod; f, second pereopod; g, third pereopod; h, fourth pereopod; i, fifth pereopod. a, $\times 24$; b, c, $\times 40$; d-i, $\times 20$.

the basal being about as long as the distal three together. Of these three the middle is the shortest and the distal the longest. The merus is about as long as the carpus. The third leg is short and reaches about to the base of the scaphocerite. The dactylus is about as long as, but much narrower than, the propodus; it is slightly curved and ends in an acute tip. The carpus is 1.5 times as long as the propodus and has the same breadth as that joint. The merus is about twice as long as the propodus and bears a strong spine near the distal margin. The ischium, which is about as long as the merus, also bears a strong spine; this spine is placed near its posterior margin. The fourth leg reaches about to the end of the scaphocerite. The dactylus is small, narrow and has a blunt top. The propodus is about 2.5 times as long as the dactylus and about as long as the carpus. The merus is almost twice as long as the carpus, while the ischium measures about $3/4$ of the length of the merus. The fifth leg reaches less far than the third. The dactylus is narrow and curved. The propodus is broader than, but as long as the dactylus and also of about the same length as the carpus. The merus is about twice as long as the carpus and is shorter than the ischium. The third maxilliped and the last three legs are provided with long plumose setae.

The relation between the length of the various joints of the first two legs of our specimens differs somewhat from that shown in Balss' figure. Since, however, this relation is not mentioned in Balss' description, it may have been incorrectly interpreted by the artist.

As Balss already pointed out, it is very probable that the specimen from Saleh Bay, Sumbawa, provisionally identified by De Man (1911, pp. 135-138) with *Ogyrides sibogae* (De Man), actually belongs to the present species. The only differences we can find are: (1) the rostrum in De Man's specimen reaches not so far forwards as in Balss' and our own material, and (2) in De Man's specimen there are four instead of three spines on the mid-dorsal line of the carapace.

Ogyrides mjobergi was described after two specimens from Cape Jaubert, NW Australia (depth 16.5 m). De Man's specimen, discussed above, originates from Saleh Bay, Sumbawa, Lesser Sunda Islands, Indonesia (depth 0 to 36 m). It seems probable that the species has a rather wide distribution throughout the Indo-West Pacific region and that it inhabits the Red Sea, so that it can have reached the E Mediterranean through the Suez Canal. Because of its small size the occurrence of the species may have been overlooked in localities other than the Israel coast, the Lesser Sunda Islands and NW Australia.

Family HIPPOLYTIDAE

Hippolyte longirostris (Czerniavsky, 1869)

Hippolyte sp. Gottlieb, 1953, p. 440

Israel material has been examined from: Haifa Bay (samples 71, 120, 231, 281), Caesarea (rock pools, 6.XI.1951, 23.I, 31.III, 30.VII, 4 and 5.VIII.1952). A total of 16 specimens with lengths of 7 to 13 mm was collected from depths down to 34 m; four of these specimens are ovigerous females (lengths 10 to 13 mm) which were taken in March, July and August.

Hippolyte longirostris, which is also reported under the name *Hippolyte* (or *Virbius*) *gracilis*, inhabits the entire Mediterranean. It is also known the S coast of England and the Black Sea; there are some doubtful records from French Guinea (W Africa). E Mediterranean records are: Cephalonia off W Greece (Heller 1863), Bujuk-Cekmeca, Sea of Marmara (Ostroumoff 1896).

Thoralus cranchii (Leach, 1817)

Only a single specimen (length 8 mm) is represented in the collection studied. This specimen was collected in Haifa Bay (sample 231, depth 19 m).

Thoralus cranchii is known from the entire Mediterranean and the E Atlantic from the North Sea to the Gulf of Guinea. The previous records from the E Me-

diterranean are : Peloponnesos, Greece (Guérin 1832), Istanbul, Turkey (Ostroumoff 1896, as *Hippolyte Bunseni*).

Family PROCESSIDAE

***Processa canaliculata* Leach, 1815**

Processa canaliculata Gottlieb, 1953, p. 440; Nouvel and Holthuis, 1957, p. 33, figures 149-173.

From the following Israel localities material was examined by us: off Nahariya (sample 661), Haifa Bay (samples 88, 111, 117, 142, 225, 266, 360, 377), off Caesarea (samples 684, 753, 824), off Kfar Vitkin (samples 520, 617, 669), off Natanya (samples 777, 820, 845), off Herzliya (samples 567, 568, 645, 746, 766, 835), off Tel Aviv (samples 523, 526, 527, 692, 769, 838, 1048), off Nabi Rubin (samples 573, 574B, 717, 817, 840, 1051), off Nabi Yunis (samples 625, 813, 992), off Ashkelon (samples 579, 580), off Gaza (samples 629, 680), off Rafah (samples 548, 550). Most of the material was obtained from depths between 18 and 101 m, only two lots being taken at 137 and 235 m respectively. A total of 53 specimens was collected, their lengths varying between 4 and 29 mm. Four females (lengths 20 to 29 mm) are ovigerous; they were taken in the months June, July and October (samples 527, 568, 766, 813).

The larger part of the material could be identified with certainty. This was not entirely possible, however, with the very small specimens less than 10 mm long (samples 548, 550, 625, 629, 661, 717, 746, 753) and a few damaged specimens (samples 769, 817, 835, 838, 1048, 1051), though there are no indications that these specimens belong to a different species.

It is curious to note that although at least 8 species of *Processa* occur in the Mediterranean, only *P. canaliculata* is known with certainty from Israel waters. This species is known to inhabit the entire Mediterranean and the Atlantic coast of Europe from the North Sea southwards.

Until recently numerous species were confused under the name *Processa canaliculata*, so that the records of this species given in the literature generally cannot be trusted. E Mediterranean records of *Processa "canaliculata"* are : near Cape Kephala, Anatolia, Turkey (Santucci 1928), various localities in Israel (Gottlieb 1953, Nouvel and Holthuis 1957), near Alexandria, Egypt (Balss 1936). The Rijksmuseum van Natuurlijke Historie recently received from the Station Marine d'Endoume at Marseilles a specimen of this species from NW of Iraklion, Greece, 35°21'24"N 25°06'30"E, depth 50 m, IX.1955, cruise of the "Calypso", Sta. 748. Other E Mediterranean material of this species was examined in the U.S. National Museum at Washington, D.C. which possesses 4 specimens from Istanbul (H.C. Kellers, XII. 1922). The E Mediterranean records of *Nika (=Processa) edulis* enumerated in the appendix, may partly or wholly pertain to the present species.

Family PANDALIDAE

***Plesionika edwardsii* (Brandt, 1851)**

Three specimens, among which two ovigerous females, were trawled in the Natanya-Herzliya area off the Israel coast at a depth of 329 to 420 m (24.V.1955, leg. O. H. Oren). Both ovigerous females had the rostrum broken; the distance between the fifth dorsal tooth of the rostrum and the tip of the telson in these specimens is 100 and 116 mm, respectively. The third specimen is 90 mm long.

Plesionika edwardsii has been indicated by many authors with the name *Parapandalus narval*, which, however, belongs to quite a different species (see Holthuis 1947, p. 316).

The species inhabits the entire Mediterranean and also has been found off the Atlantic coast of Morocco. We do not know of any previous record of it from the E. Mediterranean.

***Chlorotocus crassicornis* (Costa, 1871)**

Three specimens were examined; they originated from: Haifa Bay (sample 123, depth 73 m), off Caesarea (sample 563, depth 90 m), off Gaza (sample 658, depth 135 m). The specimens are 28, 30 and 27 mm long respectively, and none is ovigerous.

Chlorotocus crassicornis is known from the entire Mediterranean, from the E Atlantic (from the Bay of Biscay to the Belgian Congo), from S and E Africa and from the Andaman Sea. The previous records from the E Mediterranean are: E. of the Peloponnesos, Greece, 37°0'N 24°28'E; Sporades, 36°47'N 26°29'E (Adensamer 1898, as *C. gracilipes*).

***Icotopus amplissimus* Coutière, 1907**

Two specimens of a larval Decapod (length about 30 mm) were found in the stomach contents of a tuna (*Thunnus thynnus* (L.)) caught in XI. 1952 off the Israel coast. These larvae agree very well with Coutière's (1907, pp. 23-26, figure 7) description and figure of *Icotopus amplissimus* and certainly belong to that species. Though it is generally understood that genus *Icotopus* is based on larval stages of the family Pandalidae, the adult forms of neither *Icotopus amplissimus* nor that of the other species of the genus are known.

The three type specimens of *Icotopus amplissimus* were collected near the Balears and near the Canary Islands. No other specimens have since been reported.

Family CRANGONIDAE

***Pontocaris cataphracta* (Olivi, 1792)**

Aegon cataphractus Gottlieb 1953, p. 440.

Israel material from the following localities was examined: Haifa Bay (samples 149, 179, 180, 198, 209, 213, 241, 254, 267, 289), off Atlit (samples 509, 683),

off Nabi Yunis (depth 145 m, 5.V.1953). The specimens examined varied in length between 18 and 30 mm; they were obtained from depths between 24 and 145 m. The only ovigerous female (length 27 mm) was collected in October (sample 149). The species is also commonly caught by trawlers off the Israel coast.

Pontocaris cataphracta inhabits the entire Mediterranean and the E Atlantic from S Portugal to S Africa. It has also been reported from S Arabia and India. E Mediterranean records are: Peloponnesos, Greece (Guérin 1832, as *Egeon loricatus*), St. Georges Bay, Beirut, Lebanon (Monod 1931), Israel (Gottlieb 1953), near Alexandria, Egypt (Balss 1936).

***Pontophilus bispinosus* Westwood, 1835**

Material was collected at: Haifa Bay (samples 75, 108), off Atlit (sample 683), off Natanya (samples 703, 844), off Tel Aviv (samples 690, 705, 718). The material was collected at depths between 18 and 90 m. Each of the samples contains only one specimen; these 8 specimens measure 4 to 11 mm. Three are ovigerous; they are 6, 10 and 11 mm long, respectively, and were collected in June and September (samples 75, 108, 703).

The posterior of the two median spines of the carapace is inconspicuous in most specimens, only in the material of samples 683 and 703 is it well developed.

Pontophilus bispinosus is known from S Iceland, the Faeroes and W Norway southward to the Azores and the entire Mediterranean. The only previous record from the E Mediterranean is: Ras Beirut and St. Georges Bay, Beirut, Lebanon (Monod 1931).

Supersection MACRURA REPTANTIA

Section *PALINURIDEA*

Family *SCYLLARIDAE*

***Scyllarus arctus* (L., 1758) (Plate I, figure 2)**

Scyllarus arctus Bodenheimer 1935, p. 466, plate 68, figure 5; Bodenheimer 1937, p. 281; Gottlieb 1953, p. 440.

The collection of the Sea Fisheries Research Station of Haifa possesses two female specimens of this species (1 ovigerous with cl. 24 mm, the other with cl. 26 mm) which were collected in Israel Mediterranean waters, where the species evidently is quite rare. Steinitz (1933, p. 146) stated that he did not find it near Haifa, while Bodenheimer (1935) also mentioned its rarity.

Scyllarus arctus is known from the entire Mediterranean and from the E Atlantic between the S coast of England and the Gulf of Guinea. It has also been reported from the E and W coast of America and from the Indo-West Pacific region; these latter records, however, need confirmation. Records from the E Mediterranean are: W of Crete, 35° 50'N 21° 30'E (Stephensen 1923), Gulf of Lakonia, S Greece

(Guérin 1832), Phaleron Bay near Athens (Athanasopoulos 1917), Gulf of Aigina, Greece, $37^{\circ} 52'N$ $23^{\circ} 09'E$ (Stephensen 1923), Sea of Marmara, $40^{\circ} 54'N$ $28^{\circ} 53'E$, $40^{\circ} 48'N$ $27^{\circ} 59'E$, and $40^{\circ} 45'N$ $27^{\circ} 43'E$; Dardanelles, $40^{\circ} 16'N$ $26^{\circ} 32'E$; N Aegean Sea, $40^{\circ} 02'N$ $25^{\circ} 55'E$, $38^{\circ} 49'N$ $25^{\circ} 09'E$, and $38^{\circ} 13'N$ $24^{\circ} 48'E$; Sporades, $37^{\circ} 52'N$ $26^{\circ} 22'E$, $36^{\circ} 12'N$ $27^{\circ} 16'E$, and $35^{\circ} 59'N$ $28^{\circ} 14'E$ (Stephensen 1923), Rhodes (Tortonese 1947), SE of Crete, $34^{\circ} 23'N$ $27^{\circ} 57'E$, $34^{\circ} 0'N$ $26^{\circ} 20'E$, and $33^{\circ} 20'N$ $27^{\circ} 30'E$ (Stephensen 1923), Gulf of Alexandretta (= Iskenderon), Turkey (Monod 1931), Syria (Gravel 1931), Israel (Bodenheimer 1935, 1937; Gottlieb 1953), N of Egypt, $32^{\circ} 10'N$ $29^{\circ} 50'E$, $32^{\circ} 24'N$ $26^{\circ} 51'E$, and $33^{\circ} 10'N$ $25^{\circ} 35'E$; N of Cyrenaica, $32^{\circ} 10'N$ $24^{\circ} 46'E$, $33^{\circ} 11'N$ $21^{\circ} 44'E$, and $34^{\circ} 20'N$ $21^{\circ} 10'E$ (Stephensen 1923).

***Scyllarides latus* Latreille, 1803 (Plate I, figure 3)**

Scyllarides (*Scyllarus*) *latus* Steinitz 1933, p. 146.

Scyllarus latus Bodenheimer 1935, p. 466.

Scyllarides latus Bodenheimer 1937, p. 281; Gottlieb 1953, p. 440.

The Haifa Sea Fisheries Research Station possesses a male (cl. 100 mm) and a female (cl. 130 mm) from the Mediterranean coast of Israel, and some material which was collected on 12. VIII. 1946, by a trawler in the Caesarea-Natanya area. *Scyllarides* proves to be more common in Israel waters than *Scyllarus*, as has already been stated by Steinitz (1933) and Bodenheimer (1935). In the W Mediterranean *Scyllarides* is the rarer of the two. Steinitz (1933) mentioned that he saw specimens of this species more than once offered for sale at the Haifa fishmarket.

Scyllarides latus inhabits the entire Mediterranean. It has also been reported from Portugal, the Azores and the Canary Islands. Records from tropical W Africa and the Red Sea need confirmation. E Mediterranean records are : Gulf of Lakonia and Gulf of Aigina, S Greece (Guérin 1832), Syros, Cyclades (Guérin 1832), Rhodes, Sporades (Maldura 1938, Tortonese 1947, 1947a), Syria (Gravel 1930), Beirut, Lebanon (Gravel 1929, 1931, Monod 1931), Israel (Bodenheimer 1935, 1937, Gottlieb 1953), Haifa, Israel (Steinitz 1933), Egypt (Audouin 1826), ? N of Egypt, $33^{\circ} 10'N$ $25^{\circ} 35'E$ (Stephensen 1923). In the U.S. National Museum, Washington, D. C., several specimens from Beirut, Lebanon (W. T. van Dijk, 1877-78) were examined. The Museum of the Academy of Natural Sciences in Philadelphia possesses a specimen from the same locality.

Section THALASSINOIDEA

Family LAOMEDIIDAE

***Jaxea nocturna* Nardo, 1847**

Jaxea nocturna Gottlieb 1953, p. 440.

Material has been examined from : Haifa Bay (samples 161, 377), off Caesarea (samples 565, 643), off Natanya (sample 703), off Herzliya (sample 645), off Tel

Aviv (samples 779, 800, 804), off Nabi Rubin (samples 575, 797, 798, 990), off Nabi Yunis (samples 787, 992), off Ashkelon (samples 580, 581), off Gaza (samples 539a, 629, 656), off Rafah (sample 633). The material was obtained at depths between 45 and 137 m. A total of 24 specimens was examined, the lengths of which varied between 8 and 29 mm. No ovigerous females were found in this material.

Jaxea nocturna is known from the entire Mediterranean and from the British Isles. The rather numerous records of the species from the Adriatic Sea and the extensive series collected during the bottom investigations off the Israel coast give the impression that the species is commoner in the E than in the W Mediterranean. Balss (1936, p. 14) reported the species from Alexandria. Gottlieb (1953) was the first to mention its occurrence on the Israel coast.

Family CALLIANASSIDAE

***Callianassa minor* Gourret, 1887 (Figures 11, 12)**

Callianassa stebbingi Gottlieb 1953, p. 440.

In the collection studied this species is represented by material from: off Nahariya (sample 637), Haifa Bay (samples 60, 62, 82, 88, 120, 121, 169, 186, 192, 199, 249, 263, 268, 288, 293, 334, 346, 365, 381, 412) off Atlit (samples 710, 809, 1002), off Natanya (sample 688), off Gaza samples (538, 656). The material was obtained from depths between 27 and 82 m; it consists of 34 specimens 4 to 20 mm long; no ovigerous females were observed.

Description. — The rostrum is triangular in dorsal view and is sharply pointed. It reaches beyond the middle of the eyes. The lateral margin of the rostrum merges with the orbital margin. Just below the orbit the anterior margin of the carapace makes an almost rectangular curve backwards, forming thereby the rounded lower orbital angle. At some distance behind this angle the anterior margin curves downwards rather abruptly and there again forwards to merge finally with the lateral margin of the carapace under a broadly rounded curve. By this peculiar course of the anterior margin it seems as if a rectangular portion were cut out of the carapace just below the orbit. The linea thalassinica is distinct and it forms a continuation of the upper margin of the just mentioned rectangle. The cervical groove is distinct and is situated in the posterior third of the carapace. No transverse groove is visible immediately behind the rostrum.

The second segment of the abdomen is slightly longer than the first and distinctly longer than the third. The pleurae of the second to fifth segments are broadly truncate with the posterior angle broadly rounded; the distal margin is usually somewhat concave. A tuft of hairs is present in the posterior part of the pleurae of the second to fifth segments, while a transverse row of posteriorly directed hairs runs over the pleurae of the third, fourth and fifth segments.

In the third segment this row is placed in the posterior part of the pleura, in the fourth it lies about in the middle, while in the fifth it is placed in the anterior part. The sixth segment is about 1.5 times as long as the fifth. Its pleura is little pronounced and its postero-lateral angle is rectangularly rounded. In their posterior third the lateral margins of this segment show a vague constriction. The posterior margin of the segment is straight, being somewhat depressed in the middle. The telson is slightly shorter than the sixth segment; it is broadly triangular with a truncate or rounded top. The greatest breadth of the telson lies somewhat above its base. The length of the posterior margin is slightly less than half the greatest breadth of the telson and is slightly convex. The postero-lateral angles of the telson are rounded.

The eyes are of the usual triangular shape with a blunt top. Their inner margins touch each other over their full length. The cornea is small but distinct and lies a short distance behind the apex of the eye. The eyes reach slightly beyond the end of the basal segment of the antennular peduncle.

The antennular peduncle has the basal segment about 1.5 times as long as the second and about as long as the third segment. Two simple flagella are present. The antennal peduncle has the last joint somewhat shorter than the penultimate. The scaphocerite is small and ends in a minute point.

The mandible ends in a few bluntly truncated teeth; a large three-jointed palp is present. The maxilla has the lower endite short and broad, the upper is longer and more slender; the palp is well developed, with the ultimate half directed backwards ending in a slender spine. The maxilla has both endites deeply incised; the palp and the scaphognathite are well developed. In the first maxilliped the endites of the basis and coxa are well separated by a distinct notch; the palp is very short and consists of two joints; the exopod is oval in outline and shows no flagellum; the epipod is large and unequally bilobed. The second maxilliped is small and pediform; the propodus is only slightly longer than broad and about twice as long as the dactylus. The exopod is slender and fails to reach the end of the merus. The third maxilliped also is pediform, reaching with the ultimate two joints beyond the antennular peduncle. The dactylus measures $3/4$ of the length of the propodus, which is about as long as the carpus. The posterior margin of the propodus is slightly, that of the carpus strongly, convex. The merus and ischium are slender and do not form a kind of operculum over the other mouth-parts. The merus is slightly shorter than the carpus and shows a strong tooth in the distal part of its posterior margin. The ischium is about 1.5 times as long as the merus and has a high serrated crest running diagonally over its inner surface. The proximal posterior angle of the ischium is rectangular and strongly projects over the base of this joint. The basis ends posteriorly in one or two sharp teeth. A well developed exopod is present, reaching beyond the end of the ischium.

The branchial formula is as follows:

	maxillipeds			pereiopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	—	—	—	—	—	—	—	—
Arthrobranchs	—	—	2	2	2	2	2	—
Podobranchs	—	—	—	—	—	—	—	—
Epipods	1	1	1	—	—	—	—	—
Exopods	1	1	1	—	—	—	—	—

The first legs are strong; they reach with part of the merus beyond the antennular peduncle. The left and right legs are very unequal in shape. The smaller (i. e. the slenderer) of the two has the chela very elongate and narrow. The fingers are slightly shorter than the palm and are very slender. The cutting edges in their distal half are provided with about eight teeth, the posterior of which are the largest. These larger teeth are slender, sharply pointed and directed backwards. The proximal part of the cutting edge is unarmed; when the chela is closed a distinct gap remains between the unarmed parts of the cutting edges. The palm is more than three times as long as high and broadens slightly proximally. The carpus is slightly longer than high; its height is about the same as that of the palm. The merus is about 1.5 times as long as the carpus; its lower margin bears a single slender tooth in its proximal part. The ischium is distinctly longer than the merus and shows about three or four teeth on its lower margin. The larger leg is far less slender than the smaller. The fingers are about 0.8 times as long as the palm. The cutting edge of the fixed finger bears two broad and inconspicuous teeth, that of the dactylus possesses several smaller teeth which are placed in its middle. The palm is less than twice as long as high. The carpus, which is of about the same height as the palm, is shorter than high. The length of the merus is about equal to the height of the palm. The lower margin of the merus bears a distinct sharp tooth in its proximal part, while a few smaller teeth and denticles are placed before this tooth. The ischium is distinctly longer than the merus and bears several small teeth on the lower margin. The second legs reach with part of the carpus beyond the antennular peduncle. The fingers are about twice as long as the palm and they close over their full length while the tips are crossing. The cutting edge of the fixed finger bears about six distinct teeth in its middle part; the edge of the dactylus bears several much smaller teeth. The palm is considerably higher than long. The carpus is about as long as the fingers and narrows proximally. The merus is almost twice as long as the carpus, whilst the ischium is short. The third leg reaches slightly beyond the end of the antennular peduncle. The dactylus is narrow and pointed; it is much narrower than and slightly more than half as long as the propodus, which is about oval in outline. The carpus is about as long as the propodus and distinctly shorter than the merus. The coxa is posteriorly produced to a conspicuous rounded process. The fourth leg reaches about to the end

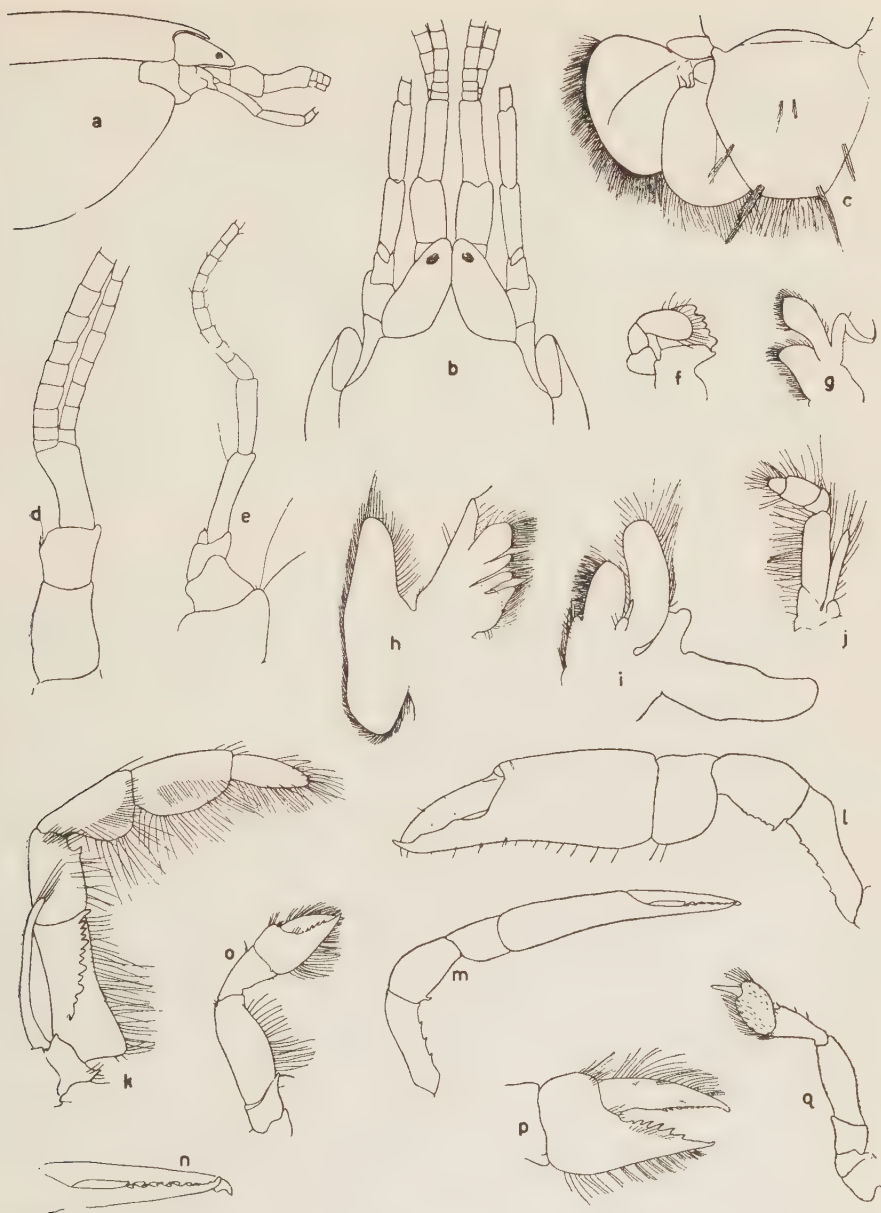


FIGURE 11.

Callianassa minor Gourret. a, anterior part of body in lateral view; b, anterior part of body in dorsal view; c, telson and left uropod; d, antennula; e, antenna; f, mandible; g, maxillula; h, maxilla; i, first maxilliped; j, second maxilliped; k, third maxilliped; l, larger first pereiopod; m, smaller first pereiopod; n, fingers of smaller first pereiopod; o, second pereiopod; p, chela of second pereiopod; q, third pereiopod. a, c, l, m, o, q, $\times 12$; b, n, p, $\times 24$; d-k, $\times 20$.

of the antennular peduncle. It is similar in shape to the previous leg, being only somewhat more slender. The propodus is about 1.5 times as long as the dactylus, distinctly shorter than the carpus and slightly less than half as long as the merus. The coxa is strongly broadened anteriorly and posteriorly; the anterior expansion is broadly rounded, the posterior is narrower. No spines are present on any of the joints of this or of the previous leg. The fifth pereopod almost reaches to the end of the eyes. The dactylus is ovate and ends in a rather narrow tip; it is slightly twisted and has some small denticles on the anterior margin. With a prolongation of the propodus it forms a kind of chela. The propodus is about twice as long as the dactylus, being about as long as the carpus. The merus is distinctly longer than the carpus. Between the coxae of the fourth legs the sternum shows a diamond-shaped thickening, which strongly resembles a Penaeid thelycum, but is found here in both sexes. The angles of this diamond-like structure are broadly rounded. A transverse groove, which is curved backwards in the middle, runs across this part of the sternum, while from the middle of this groove a narrow slit runs backwards to the posterior angle of the diamond.

Both the males and the females have the first abdominal segment provided with a pair of two-jointed pleopods. In the males these pleopods are very small; the ultimate joint is about as long as the basal joint and is provided with an appendix interna, the tip of the ultimate joint is curved towards the tip of the appendix so that this joint superficially resembles a chela. In the females the first pleopods are much larger than in the male. The ultimate joint is simple, without appendices, and is much longer than the basal joint. The endopod of the second pleopod of the male bears an appendix interna as well as an appendix masculina. The latter is very short and broad, being distinctly broader and shorter than the appendix interna. Both appendices are placed so close to the top of the endopod that the appendix masculina reaches beyond this top. The third to fifth pleopods of the male and the second to fifth of the female have the exo- and endopods broadly lamellar, the endopod being provided with a single appendix interna. The protopod of the uropods is ovate. The exopod is broadly triangular with the posterior margin convex. This posterior margin bears a row of spines which are smallest in the external part, gradually becoming longer internally. Near the base of the exopod is a tooth which may overreach the base of the endopod. A carina is visible on the upper surface of the exopod. The endopod is about oval in outline, its dorsal surface bearing a single rather indistinct longitudinal carina.

The species was described for the first time in 1887 by Gourret, who considered it to be a variety of the well known species *Callianassa subterranea* (Montagu 1808) (cf. Gourret 1887, p. 1034; 1887a, p. 1132). One year later Gourret (1888, pp. 31, 96, plate 8, figures 1—15) published an extensive description and some rather poor figures of his new form. Gourret's material came from Ile Pomègue near Marseilles. In 1898 Adensamer (1898, p. 620) reported from the Aegean Sea (37°37' N 26°58' E) a specimen of *Callianassa*, which he identified as *C.*



FIGURE 12.

Callianassa minor Gourret. a, fourth pereopod; b, fifth pereopod; c, propodus and dactylus of fifth pereopod; d, first pleopod of male; e, first pleopod of female; f, second pleopod of male; g, second pleopod of female; h, third pleopod of male. a, b, $\times 12$; c-f, $\times 40$; g, h, $\times 20$.

subterranea. According to Pesta (1918, p. 205), Adensamer's specimen probably belongs to the present form. Pesta himself (1916, p. 227; 1918, p. 205) reported a specimen, which he considered as belonging here, from the S Adriatic Sea. Finally Balss (1936, p. 16, figure 15) with some doubt recorded *Callianassa subterranea minor* from near Alexandria. From the accounts given by Pesta and Balss it seems probably that their material as well as that reported by Adensamer actually belongs to the present species. Also, the material mentioned by Gottlieb (1953) from Israel under the name *C. stebbingi* proved to be *C. minor*. Since this species is so insufficiently known, a description and figures are given here.

Gourret's specimens were found at a depth of 30 m "dans les mélobésies des fonds coralligènes", Adensamer's single specimen at 92 m on a bottom of "gelbgrauer und grauer Schlamm", while Balss' specimen was collected at a depth of 40 m on a muddy Phoronis bottom. Nothing is known of the habitat of Pesta's specimen.

The systematic position of the present form is not yet very clear. Gourret (1887, 1887a, 1888), Pesta (1916, 1918) and Balss (1936) treated it as a variety of *Callianassa subterranea* (Montagu); this was also done by Borradaile (1903, p. 546) in his classification of the Thalassinidea. De Man (1928, pp. 26, 100) raised it to the rank of a full species, while Bouvier (1940, pp. 101—102) sank it as a synonym of *Callianassa subterranea*, considering it to be based on a juvenile stage

of that species ("Il ne paraît point douteux que la variété *minor* de Marseille représente un jeune de l'espèce"). Bouvier certainly is mistaken here, and there can be little doubt that De Man was correct in considering the present form to be a distinct species. It is sufficiently characterized by the curious shape of the chelae and by the presence of an exopod at the third maxilliped. This latter character, as far as is known to us, has until now been found only in one other species of *Callianassa*, viz., *C. novaebritanniae* Borradaile 1899. No attempt has been made here to assign *Callianassa minor* to any of the subgenera into which the genus *Callianassa* has been divided by several authors. The status of these subgenera, namely, is most uncertain, as the characters on which they are based are highly unsatisfactory, being so trivial and variable that they certainly cannot be considered to be of subgeneric value. Practically all authors cited above placed the species in a subgenus which they named *Cheramus* Bate, 1888, but which, if recognized at all, should be known as *Callianassa* Leach s. s., since it contains the type species of the genus *Callianassa*.

***Callianassa tyrrehena* (Petagna, 1792) (Figure 13)**

Callianassa (Callichirus) stebbingi Steinitz, 1933, p. 147.

Callianassa stebbingi Bodenheimer, 1937, p. 281.

Material has been examined from: off Nahariya (sample 638), Haifa Bay (samples 148, 225), Tantura (5 and 6.VII.1955), off Kfar Vitkin (sample 668), off Tel Aviv (sample 838), off Nabi Rubin (sample 741), off Nabi Yunis (sample 787), off Ashkelon (samples 579a, 652), off Rafah (sample 545). The Tantura specimens are well preserved and of good size (17 to 42 mm); the other material is generally much smaller (4 to 16 mm) and many of the specimens lack part or all of the legs.

The Tantura specimens show all the characters of Petagna's species and there can be little doubt as to their identity. The smaller specimens show some differences from the adults, which differences, however, are due only to age. The specimen from off Nabi Rubin (sample 741), which has a length of 11 mm, is the least damaged of the small specimens, and is the only one with both first legs still attached. The rostrum of this specimen is broadly triangular and fails to reach the end of the proximal third of the eyes. Its lateral margins merge with the anterior margin of the carapace, which is somewhat concave near the end of the linea thalassinica, but does not show a rectangular incision as in *C. minor*. The cervical groove, in the posterior third of the carapace, is quite distinct; there is no transverse groove immediately behind the rostrum.

The second segment of the abdomen is distinctly longer than either the first or the third. The pleurae of the third to fifth segments are truncated, with both angles rounded and the distal margin slightly concave. Each of these pleurae bears a conspicuous tuft of hairs. The sixth segment is about 1.5 times as long as the fifth and about as long as the telson; it is somewhat constricted in the posterior

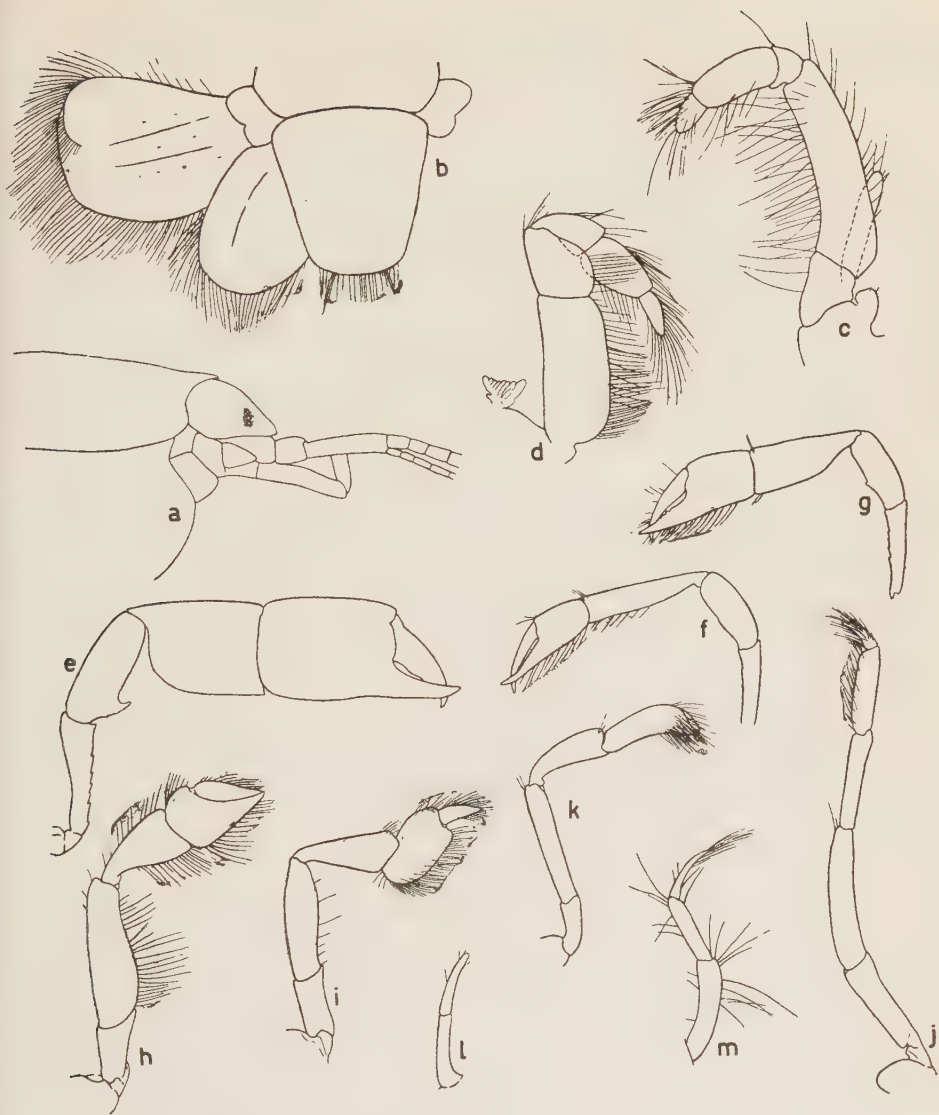


FIGURE 13.

Callianassa tyrrhena (Petagna), juvenile. a, anterior part of body in lateral view; b, telson and left uropod; c, second maxilliped; d, third maxilliped; e, larger first pereiopod, specimen from sample 741; f, smaller first pereiopod, same specimen; g, smaller first pereiopod, specimen from sample 668; h, second pereiopod; i, third pereiopod; j, fourth pereiopod; k, fifth pereiopod; l, first pleopod of male from sample 838; m, first pleopod of female from sample 668. a, b, $\times 20$; c, l, $\times 50$; d, m, $\times 25$; e, f, $\times 10$; g, $\times 7$; h-k, $\times 15$.

third. The telson is quadrangular. Posteriorly, the telson is about half as wide as anteriorly. The posterior margin is almost straight with rounded angles.

The eyes are of the usual shape and reach to about the end of the first segment of the antennular peduncle.

The antennular peduncle has the second segment much shorter than the first, whilst the third is elongate and almost as long as the first and second combined.

The antennal peduncle reaches slightly beyond the antennular. The ultimate joint is distinctly shorter than the penultimate. The scaphocerite is bluntly triangular.

The oral parts up to the second maxilliped do not differ essentially from those of the previous species. The second maxilliped has the propodus longer than in *C. minor*. The third maxilliped does not possess an exopod at all; the merus and the ischium are relatively wider than in *Callianassa minor*.

The first legs are unequal in shape and they reach with the carpus beyond the antennular peduncle. The fingers of the larger leg measure about $2/3$ of the length of the palm and are about as long as the height of the palm; their tips are crossing. The merus is far more slender and somewhat shorter than the carpus; its lower margin possesses in the proximal half a large tooth which shows some denticles on its proximal margin. The smaller first leg has very slender fingers, which are longer than the palm. The carpus is elongate and is distinctly longer than the chela. The merus measures $2/3$ of the length of the carpus and has a faint indication of a denticle on its lower margin. The ischium is as long as the merus and has the lower margin inconspicuously denticulated. The second pereopods resemble those of *C. minor*, only that they are more slender and lack the teeth on the cutting edges of the fingers; they reach with the carpus beyond the antennular peduncle. The third legs of the two species too are very similar, but that of the present form is more slender; it reaches with part of the carpus beyond the antennular peduncle. The fourth leg is slender and reaches with the propodus beyond the antennular peduncle. The propodus is fully twice as long as the dactylus and is far more elongate than in *C. minor*. The carpus is somewhat longer than the propodus, but is distinctly shorter than the merus, being of about the same length as the ischium. The fifth leg does not attain the end of the antennular peduncle. It bears an indistinct chela, which is slightly longer than the carpus. The merus is almost 1.5 times as long as the carpus.

The first pleopod of the specimen, a female, is slender and three-jointed. In a male specimen (sample 838, length 10 mm) it was found to be two-jointed, being distinctly smaller than in the female.

The other small specimens examined agree very well in most respects with the female described above; only the shape of the smaller first leg proved to vary somewhat. In the female of sample 668 (length 14 mm) the smaller first leg is far less elongate than in the female of sample 741. The carpus is shorter than

the chela and much higher than in the other specimen; the denticles on the merus and ischium are more distinct. Some intermediate forms have also been found. It is possible that the shape of this leg changes with age, but the material is too small to allow any definite conclusion here.

The fact that the small animals are not fully grown makes it exceedingly difficult to assign them with certainty to any of the known Mediterranean species. The shape of the third maxilliped suggests that it will later become operculiform as in *C. tyrrhena* (Petagna 1792), but the shape of the telson shows more resemblance to that of *C. truncata* Giard and Bonnier 1890. Since the specimens of 16, 17, and 19 mm length have the telson about intermediate in shape between that of the very small and that of the large animals, we believe this shape to change with age and therefore grade all our present material with *Callianassa tyrrhena*; we do this with more confidence since *C. truncata* has not yet been reported from the E Mediterranean.

Steinitz (1933) reported upon 13 specimens of the present species which he collected near Tel es Semak near Haifa. Steinitz mentioned the operculiform shape of the third maxilliped in his material.

The species is known also under the names *Callianassa stebbingi* Borradaile 1903 and *C. laticauda* (Otto 1821); the name *Callianassa tyrrhena* (Petagna 1792), however, has priority.

Callianassa tyrrhena has been reported from the entire Mediterranean, from the Black Sea and from the E Atlantic between S Norway and Portugal. No records from the E Mediterranean, other than that by Steinitz (1933), are known to us.

***Upogebia tipica* (Nardo, 1869)**

Upogebia littoralis Gottlieb 1953, p. 440.

Material was examined from the following Israel localities: off Nahariya (sample 661), Haifa Bay (samples 262, 266, 268, 277, 285), off Atlit (sample 1033), off Caesarea (samples 641, 642, 692a), off Kfar Vitkin (samples 667, 669), off Herzliya (samples 568, 569a, 645, 848), off Tel Aviv (samples 671, 718), off Nabi Rubin (samples 650, 743), off Nabi Yunis (samples 533, 851), off Ashkelon (sample 1024), off Gaza (samples 629, 656, 677, 680), off Rafah (samples 548, 550). The material was obtained from depths ranging from 42 to 138 m, one specimen being caught at 235 m. Among the 35 specimens dealt with here (lengths 5 to 22 mm), there are 8 ovigerous females, the lengths of which vary between 17 and 22 mm. These ovigerous females were taken during the months June, July, August and September (samples 533, 550, 568, 569a, 629, 641, 642, 692a).

The species is best known as *Upogebia gracilipes* (De Man 1927), but Nardo's (1869, p. 101, plate 2, figure 4) description and figure of *Bigea tipica* leave not the least doubt as to the identity of his species with that described by De Man.

Consequently, the name of the present form has to be *Upogebia tipica* (Nardo). In 1847 Nardo (1847, p. 7) already published the name *Bigea tipica*; but since he gave no description at that occasion the name was then a nomen nudum. It was first validly published in 1869. Since Nardo (1869, pp. 67, 101, 123, 126) consistently used the spelling *tipica* for his species, this spelling has to be accepted.

Comparison of the present material with one of the type specimens of De Man's *Upogebia gracilipes*, which is preserved in the collection of the Zoological Museum at Amsterdam, did not reveal any significant differences but for the size. The type specimen (length 44 mm), is distinctly larger than any of our specimens. Since in other respects the resemblance is so close, there is no reason to believe the present material to be specifically distinct from *U. gracilipes*.

The material mentioned by Gottlieb (1953) as *U. littoralis* (Risso) on re-examination proved to belong to the present species.

Very little is known about the distribution of *U. tipica*. Until now it has only been reported from the Adriatic Sea and from Alexandria, Egypt. It was recorded from the latter locality by Balss (1936). It is probable that the species has often been confused with *U. pusilla* (Petagna 1792) (= *U. littoralis* (Risso 1816)).

***Upogebia deltaura* (Leach, 1815)**

Four specimens with lengths varying between 5 and 20 mm were collected during the bottom investigations in Haifa Bay (samples 84, 133, 231, 316). They were obtained at depths between 18 and 20 m. These specimens, none of which is fully grown, agree quite well with De Man's (1927, p. 17, figure 8) extensive description. The few differences we found are probably due to the immaturity of the material. In our specimen from sample 84 the rostrum on each lateral margin bears two teeth, whilst there are three in the specimen from sample 133. The ischium of the larger first pereopod in the specimen from sample 84 is provided with a single ventral spine only; there is no trace of additional small spinules. The distal margin of the carpus of that leg bears two spinules to the outside of the large antero-dorsal spine, but none at the inner side of it. The spinules in the proximal part of the lower border of the palm are very small, while that on the inner surface of the palm near the base of the dactylus is absent. Of the tubercles on the upper border of the dactylus only the two proximal are visible. The spines on the coxae of the first and second legs are very distinct, but no tubercles were observed on the merus of the third legs. In the specimen from sample 133 the legs are lacking.

Upogebia deltaura is known from S Norway and SW Sweden southwards to the Mediterranean. The only previous record of the species from the E Mediterranean is that by Balss (1936, p.16), who reported it from near Alexandria.

Suborder ANOMURA

Section PAGURIDEA

Family PAGURIDAE

Subfamily DIOGENINAE

Paguristes oculatus (Fabricius, 1775)

A number of specimens was collected during the Haifa Bay bottom investigations (samples 123, 191, 206, 227, 241, 250, 254, 263, 277, 279, 289, 291, 315, 328, 374, 398). The material was obtained from depths between 33 and 92 m. The carapace lengths of these specimens lie between 4 and 8 mm. In four ovigerous females the carapace lengths vary between 6 and 8 mm; these females were collected in April, May, and June (samples 191, 206, 227, 398). In the smallest specimen (cl. 4 mm) the spines on the chelipeds and the ambulatory legs are far more conspicuous than in the larger animals.

Paguristes oculatus, which is now reported for the first time from Israel, inhabits the entire Mediterranean and is also known from the E Atlantic between Cape Finistère (NW Spain) in the north and Madeira and Cape Mazagan (Morocco) in the south. A variety, *Paguristes oculatus rubropictus* A. Milne Edwards and Bouvier, 1892, inhabits the W coast of Africa between Morocco and Angola. E Mediterranean records are: Phaleron Bay near Athens, Greece (Athanassopoulos 1917, as *P. maculatus*), S end of Bosphorus, near Princes Islands (=Kizil-Adalar), near Pasha Liman Island (=Aloni) and Gallipoli, Sea of Marmara (Ostroumoff 1896, as *P. maculatus*), Khos and Rhodes, Cyclades (Santucci 1928), near Alexandria, Egypt (Balss 1936), Benghazi, Cyrenaica (Colosi 1923).

Clibanarius erythropus (Latreille, 1818)

Clibanarius misanthropus Steinitz 1933, p. 147; Bodenheimer 1935, p. 466; Bodenheimer 1937, p. 281; Gottlieb 1953, p. 440.

Clibanarius rouxi Steinitz 1933, p. 148; Bodenheimer 1935, p. 466; Bodenheimer 1937, p. 281.

Clibanarius misanthropus Carmin 1955, p. 3.

Material of this species has been examined from the following Israel localities: Caesarea (rock pools, 6.IV.1952, 26.V and 10.VI.1954, leg. E. Gottlieb), Tel Aviv (shore, 25.V.1929, and 22.V.1932, leg. J. Carmin), Bat Yam (shore, 19.VI.1929, leg. J. Carmin). Steinitz (1933, pp. 147—148) stated that he found the present species in enormous numbers in the surf zone of the rocky shores of Haifa Bay, where practically all empty shells were occupied by them. Gottlieb (1953, p. 440) reported the species from rock pools near Caesarea. Carmin's (1955) Israel record of the species is partly based on the above cited specimens from Tel Aviv and Bat Yam. Our specimens have carapace lengths varying between 4 and 13 mm. Ovigerous females, with cl. 5 or 6 mm, were collected in April and June.

The species is usually indicated with the name *Clibanarius misanthropus* (Risso 1827), but as Forest (1957 a, p. 426) pointed out, the specific name *erythropus* Latreille, 1818, for this species is older and has to be used.

Clibanarius erythropus is known to inhabit the entire Mediterranean and the E Atlantic between the French coast of Brittany in the north and the Azores and Salvage Islands in the south. It has also been reported from the Black Sea. Records from the E Mediterranean are: S end of Bosphorus, near Princes Islands (=Kizil-Adalar), near San Stefano, Pasha Liman (=Aloni), Aphisia Islands and near Gallipoli, Sea of Marmara (Ostroumoff 1896), Naxos, Cyclades (Guérin 1832), Khos, Sporades (Santucci 1928), Rhodes (Santucci 1928; Tortonese 1947), Israel (Bodenheimer 1935, 1937, Carmin 1955), Haifa (Steinitz 1933), Caesarea, Israel (Gottlieb 1953), Egypt (Audouin 1826, as *Pagurus Labillardieri*), Port Said (Balss 1927), Alexandria, Egypt (Balss 1936), Benghazi, Cyrenaica (Colosi 1923). E Mediterranean material of this species has also been examined in the collection of the U. S. National Museum, Washington D. C.; this material originates from: Istanbul (IX. 1923, H. C. Kellers), Port Said (VII. 1922, H. C. Kellers), 1 mile offshore from Mersa Matruh, Egypt (on rocks 8.X.1953, R. E. Kuntz).

***Calcinus ornatus* (P. Roux, 1830)**

Twelve specimens were obtained during the Haifa Bay bottom investigations. They occurred in samples 72, 129, 152, 167, 241, 390, 413. The material was collected at depths between 18 and 55 m. The carapace lengths of these specimens vary between 2.5 and 6 mm. The only ovigerous female (cl. 6 mm) was collected in July (sample 241).

Calcinus ornatus is known from the entire Mediterranean, from the Azores and from the Canary Islands; it seems to be nowhere common. The only previous record from the E Mediterranean is that by Balss (1936, pp. 20–21) who reported it from near Alexandria, Egypt.

***Diogenes pugilator* (P. Roux, 1829)**

Diogenes varians Bodenheimer 1935, plate 68, figure 4.

Diogenes pugilator Gottlieb 1953, p. 440.

Seven specimens, have been examined; they were collected in the following Israel localities: Haifa Bay (samples 147, 215; shore, 26.XII.1954), off Tel Aviv (sample 705). These specimens (cl. 3 to 7 mm) were collected at depths down to 30 m; one of them is ovigerous (cl. 5 mm); it was taken in October (sample 147).

The specimen from the shore near Haifa has the left chela elongate as figured by Bouvier (1940, p. 123, figure 81); in the material from samples 215 and 705 the chela is similar though slightly shorter. The specimens from sample 147, however, have the left chela short, with a crest of strong spines on the upper border of the palm and a broad longitudinal ridge in the proximal part of the

median region of the outer surface of the palm; a few short spines and several tubercles are present on this ridge. The lower margin of the chela is evenly convex, the fixed finger not being directed downwards. On the carpus and the merus the spines are also more pronounced than in the other specimens. In all the specimens the propodus of the ambulatory legs, and less distinctly so the carpus and merus, show an orange reddish spot in the middle.

Diogenes pugilator inhabits the entire Mediterranean and the Black Sea. It is known also from the E Atlantic between the S North Sea (Holland, Belgium) and the S coast of Great Britain in the north, to Angola in the south. Furthermore, the species has been recorded from the Red Sea and Singapore. The following records have been made from the E Mediterranean: Sapienza and Cape Tainaron, S Greece (Guérin 1832), near Bujuk-Cekmeca, near San Stefano, and E coast of Aphisia Island, Sea of Marmara (Ostroumoff 1896), St. Georges Bay, Beirut, Lebanon (Monod 1931), Israel (Gottlieb 1953), Great Bitter Lake and Lake Tim-sah, Suez Canal (Fox, 1926, 1927a; Balss 1927; Gurney 1927, 1927a; Holthuis 1956), near Alexandria, Egypt (Balss 1936), Benghazi, Cyrenaica (Colosi 1923). The first Israel record of the species is that by Gottlieb (1953, p. 440); though Bodenheimer (1935, plate 68, figure 4) figured the species, it was not mentioned by him in the text of his book.

Dardanus arrosor (Herbst, 1796) (Plate I, figure 4)

Pagurus arrosor Gottlieb 1953, p. 440.

This species is represented from the following Israel localities: Haifa Bay (samples 56, 151, 152, 165, 167, 180, 190, 233, 241, 260, 294, 305, 312, 315, 318, 328, 336, 374; deep water trawling, June 1954), off Atlit (in trawl, October 23, 1946). Numerous specimens (cl. 5 to 28 mm) were collected; they were taken at depths between 35 and 100 m. There are at least two ovigerous females (cl. 14 and 27 mm) which were collected in June and August (sample 56).

Dardanus arrosor inhabits the entire Mediterranean and E Atlantic between Portugal and Angola. It has also been recorded from the E coast of America, from the Red Sea, Japan, the Philippines and New Zealand. E Mediterranean records are: Peloponnesos and Isthmus of Korinthos, S Greece (Guérin 1832, as *Pagurus striatus*), Phaleron Bay near Athens, Greece (Athanassopoulos 1917, as *P. striatus*), Rhodes (Tortonese 1947, 1947a), Israel (Gottlieb 1953), Egypt (Audouin 1826, as *Pagurus incisus*).

Dardanus callidus (Risso, 1827)

not *Pagurus calidus* Gottlieb 1953, p. 440.

A detached large chela of this species was collected in Haifa Bay (sample 303, depth 38 to 44 m). Gottlieb (1953) reported the species from Israel, but his record was based on an incorrectly labelled specimen, which did not come from the Mediterranean coast of Israel.

Dardanus callidus is known from the entire Mediterranean and from the E Atlantic between Portugal and the Cape Verde Islands. The only record from the E Mediterranean known to us is that by Colosi (1923), who reported the species from Benghazi, Cyrenaica.

Subfamily PAGURINAE

Pagurus sculptimanus Lucas, 1846

In the material studied the species is represented only by specimens from Haifa Bay (samples 129, 190, 233, 239, 241, 374). The material was obtained from depths between 37 and 60 m. Six specimens are present in this collection; they have carapace lengths varying between 4 and 6 mm; none of the animals is ovigerous.

Pagurus sculptimanus is known from the entire Mediterranean, and from the E Atlantic between the British Isles in the north and the Cape Verde Islands in the south. The only previous record from the E Mediterranean is by Ostroumoff (1896), who reported the species from near the lighthouse of Gallipoli, Sea of Marmara.

Pagurus spinimanus Lucas, 1846

Material was examined from the following Israel localities: Haifa Bay (samples 56, 110, 129, 135, 149, 151, 152, 154, 165, 167, 180, 190, 209, 233, 241, 254, 260, 267, 279, 281, 286, 291, 303, 305, 307, 315, 318, 325, 336, 360, 370, 374, 384, 388, 407, 412), off Caesarea (sample 682). This material was collected at depths between 18 and 88 m; it consists of 100 specimens (cl. 2 to 9 mm), among which are 7 ovigerous females (cl. 5 to 7 mm) collected in January, April and May (samples 180, 190, 209, 384, 388).

The names *Pagurus spinimanus* Lucas and *Pagurus cuanensis* Bell were both published in 1846. As pointed out by Forest (1955, pp. 114—115) Lucas' Pagurid names were published before 28.III.1846, since the publication in which they are treated was mentioned in *Bibliographie de la France*, no. 13, of that date. The part of Bell's *History of the British Stalk-Eyed Crustacea* in which *Pagurus cuanensis* was dealt with, appeared in 1846; no more accurate date of publication can be ascertained. According to the regulation laid down at the 1948 Paris Congress (cf. Hemming 1950, pp. 223—225) the name *Pagurus cuanensis* Bell must be treated as if it was published on 31.XII.1846, and *Pagurus spinimanus* Lucas as if it was published on 28.III.1846. Thus, Lucas' name has priority over the name by Bell and it should, therefore, be used.

Pagurus spinimanus is known from the entire Mediterranean and from the E Atlantic between W Norway and S Africa. The previous records of the species from the E Mediterranean are: S end of Bosphorus, near Princes Islands (=Kizil Adalar), near Rodosto (=Tekirdagh), Marmara, Aphisia and Pasha Liman (=Aloni) Islands

and near Gallipoli, Sea of Marmara (Ostroumoff 1896, as *Eupagurus lucasi*), near Alexandria, Egypt (Balss 1936).

***Pagurus alatus* Fabricius, 1775**

Eupagurus excavatus Gottlieb 1953, p. 440.

Two specimens were collected in Haifa Bay (samples 202, 320); they were taken at depths of 70 and 73 m respectively. The specimen from sample 202 has a carapace length of 6 mm, whilst the carapace of the other specimen is 13 mm long. Both are of the *meticulosus* type, having the carinae on the chela of the larger cheliped, though distinct, low and granulated.

The species is perhaps better known as *Pagurus excavatus* (Herbst), but as Forest (1955, p. 110) pointed out, the specific name *alatus* Fabricius, 1775, has priority over *excavatus* Herbst, 1791, and thus has to be used; the specific name *angulatus* Risso, 1816, has also been employed for the present species.

Pagurus alatus is known from the entire Mediterranean and the E Atlantic between W Norway and French Guinea. Records from the E Mediterranean are: Navarino Bay and Astros, S Greece (Guérin 1832), E of the Peloponnesos, Greece, 36°58' N 24°18' E, 36°40' N 23°52' E, and 36°25' N 24° 2' E (Adensamer 1898), Khania, NW Crete (Lucas 1853; Raulin 1870), off SW Turkey, 36°13' N 30° 22'E (Adensamer 1898), Israel (Gottlieb 1935).

***Pagurus prideauxi* Leach, 1815**

Three specimens have been examined; they originate from: Haifa Bay (sample 191, depth 79 m), off Natanya (11.XII.1946), off the S part of the Israel coast (trawl fishing, 5.VI.1953). The carapace lengths of these specimens vary between 7 and 12 mm; none of them is ovigerous.

Pagurus prideauxi inhabits the entire Mediterranean and furthermore is known from the E Atlantic between W Norway and the Cape Verde Islands. In the E Mediterranean it was recorded from NW of Crete, 35°48' N 23°34' E, by Adensamer (1898).

***Pagurus anachoretus* Risso, 1827**

This species is represented in the present material by two specimens collected off Nahariya (sample 551, depth 16 m, cl. 7 mm), and in Haifa Bay (sample 52, depth 18 m).

Pagurus anachoretus is known from the entire Mediterranean and from the Portuguese coast. E Mediterranean records are: Phaleron Bay near Athens, Greece (Athanassopoulos 1917, as *P. pictus*), near Alexandria, Egypt (Balss 1936).

***Catapaguroides timidus* (P. Roux, 1830)**

The species is represented in samples 98, 112, 145, 390, taken during the bottom investigations of Haifa Bay. The material was obtained at depths between 18 and

38 m. The number of specimens collected amounts to 6 (cl. 2 to 3 mm); no ovigerous females are present.

Catapaguroides timidus inhabits the entire Mediterranean and the E Atlantic from the French coast of Brittany to the Canary Islands. As far as is known to us, it has not been reported before from the E Mediterranean.

Anapagurus laevis (Bell, 1846)

Israel material has been examined from: Haifa Bay (samples 52, 191, 213, 218, 219, 250), off Atlit (samples 694, 695), off Caesarea (sample 682), off Tel Aviv (sample 691). The material was obtained at depths between 18 and 90 m. The 11 specimens have carapace lengths varying between 2 and 5 mm. The only ovigerous female (cl. 3 mm) was collected in September (sample 695). Furthermore, there is a number of specimens which probably belong to this species, but which lack the chelae and all or most of the ambulatory legs, so that their identity can not be stated with certainty; these *Anapagurus* specimens were all collected in Haifa Bay (samples 102, 112, 123, 137, 171, 191, 201, 233, 250, 257, 260, 286, 374, 405) at depths between 18 and 79 m. The size of these specimens is similar to that of the above mentioned material. Ovigerous females were collected in April, May, and June (samples 102, 191, 374, 405).

The characters enumerated by Fenizia (1937, p. 28) to distinguish the present species from *Anapagurus breviaculeatus* prove to be variable in our material. In practically all our specimens the eyestalk widens distally, but in some it is more slender than in others. The length of the scaphocerite is variable: in three of our specimens it distinctly fails to reach the base of the cornea, in five it reaches slightly beyond the lowest part of the cornea, but fails to reach the extreme distal end of the ophthalmic peduncle, and in three specimens it reaches to or slightly beyond the end of the peduncle. The propodi of the second and third legs of our specimens are generally provided with one or two disto-ventral spines; these spines are entirely absent in one specimen (sample 682), but in some they are absent in part of the legs. As far as we can judge from our material, it seems most probable that *A. breviaculeatus* and *A. laevis* cannot be considered distinct species.

In the specimen from sample 218, the large chela very strongly resembles that of *Anapagurus bicorniger* A. Milne Edwards and Bouvier as figured by Fenizia (1937, p. 34, figure 24); the merus of this leg possesses a large granulated tubercle on the lower surface; since the leg is detached it is possible that it actually belongs to a specimen of *A. bicorniger*, but this seems hardly probable.

In our specimens of *A. laevis* the carpus of the large chela bears two to eight distinct spines on the upper inner margin, while sometimes smaller spines are also present.

Anapagurus laevis inhabits the entire Mediterranean and is known from the E Atlantic between W Norway and S Africa. It has not been reported before from the E Mediterranean.

Anapagurus bicorniger A. Milne Edwards and Bouvier, 1892

Material has been examined from the following Israel localities: Haifa Bay (samples 89, 191, 206, 254, 263, 267, 279, 339, 374, 400, 405), off Caesarea (samples 753, 805), off Kfar Vitkin (sample 667), off Natanya (sample 792), off Herzliya (sample 567a), off Tel Aviv (samples 522, 671, 673), off Gaza (sample 657). The material was obtained at depths between 18 and 135 m. The collection contains 26 specimens (cl. 2 to 4 mm); two of these are ovigerous females (cl. 3 mm) collected in August and November (samples 267 and 671). The specimen from sample 657 has the two frontal spines, which characterize this species, fused into a single two-topped plate.

Anapagurus bicorniger has not been reported very often. It was known from the W Mediterranean (Banyuls, S France; Cadaqués, NE Spain; Gulf of Naples) and from the E Atlantic near Cape St. Vincent (SW Portugal) and Cadiz (Spain). It is now reported from the E Mediterranean for the first time.

Section *GALATHEIDEA*

Family GALATHEIDAE

Galathea intermedia Lilljeborg, 1851

Galathea intermedia Gottlieb 1953, p. 440.

Material was collected at : Haifa Bay (samples 108, 127, 213, 241, 250, 263, 279, 281, 289, 303, 304, 312, 336, 352, 370, 373, 374, 397, 407), off Tira (depth 62 m, 17.VIII.1947), off Atlit (samples 509, 510, 683, 694), off Tel Aviv (sample 522). This material was obtained at depths between 18 and 90 m, it consists of 42 specimens with carapace lengths ranging from 2 to 9 mm. Two ovigerous females (cl. 4 and 5 mm) were collected in May and June (samples 108, 397).

Recently, Zariquiey Alvarez (1950) showed that what most authors considered to be *Galathea intermedia*, are actually two distinct species: *G. intermedia* Lilljeborg and *G. bolivari* Zariquiey. All our material belongs to the first of these two species.

Galathea intermedia is known from the entire Mediterranean and from the E Atlantic between the NW coast of Norway and Angola. The only previous record of the species from the E Mediterranean is that by Gottlieb (1953), who reported it from Israel.

Galathea squamifera Leach, 1814

This species is represented in the collections of material from: Haifa Bay (samples 71, 96, 98, 121, 132, 133, 135, 272, 281), off Caesarea (sample 682). The material was obtained at depths between 18 and 72 m; it contains 15 specimens, the carapace lengths of which vary between 5 and 14 mm; no ovigerous females were found.

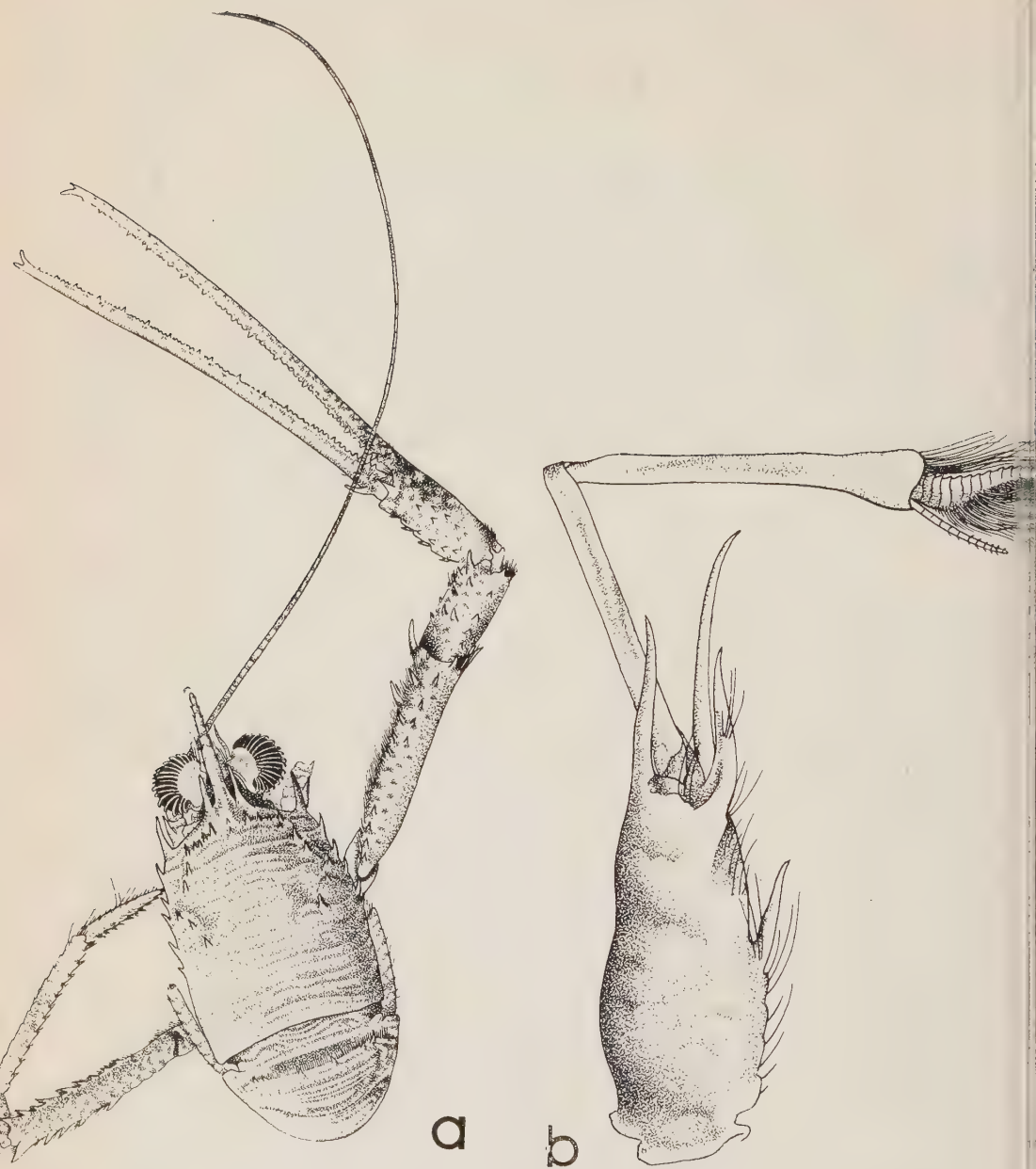


FIGURE 14.

Munida curvimana A. Milne Edwards and Bouvier. a, animal in dorsal view; b, basal segment of antennular peduncle. H. Heyn del.

The material mentioned by Wirszubski (1953, p. 17) as *Galathea* sp. belongs either to this or to the preceding species.

Galathea squamifera is known from the entire Mediterranean and from the E Atlantic between the W coast of Norway and the Cape Verde Islands. E Mediterranean records are: Piscopi, Cyclades and Capo Bove, Rhodes (Santucci 1928).

Munida curvimana A. Milne Edwards and Bouvier, 1874 (Figure 14a, b)

A male (cl. 18 mm) was collected in Haifa Bay (sample 360, depth 48—59 m). It agrees quite well with the description and figures given by A. Milne Edwards and Bouvier (1900, p. 287, plate 29, figures 12—16) and with the syntypes of that species from Cape Blanco, Mauritania, present in the collection of the Rijksmuseum van Natuurlijke Historie. The three rostral spines are squamose dorsally, the median more distinctly so than the laterals. A strong spine is placed behind each of the lateral rostral spines and from it a row of four smaller spines extends laterally, running about parallel to the orbital margin. Of these four spines the first and the last are stronger than the two intermediates. Behind the outer spine two more spines are present which are of about the same size and form an oblique row with it; this row runs about parallel to the lateral margin of the carapace. From the base of the median rostral spine a row of about four small spines extends backwards; these spines increase in size posteriorly, the last being placed just behind the line connecting the two large postrostral spines. As described by A. Milne Edwards and Bouvier (1900), on each half of the carapace three spines are placed behind each of the lateral parts of the cervical groove: one on the spot where the groove branches out and two in the region between the two lateral branches of the groove. Six marginal spines are present in our specimen: two before the anterior branch of the cervical groove, two between the two branches, and two behind the posterior branch. No other spines are present on the carapace and even the posterior margin is unarmed. The hairs on the larger part of the carapace are of the usual colour, but in the postero-lateral region several iridescent hairs are found.

In the Israel specimen the difference in the length of the ventral and dorsal hairs implanted on the base of the cornea is hardly noticeable.

The description given by A. Milne Edwards and Bouvier of the peduncle of the antennula is rather misleading. The basal segment of the peduncle is armed with two slender terminal spines, the inner of which is slightly longer than the outer. Furthermore, there are two outer lateral spines, the anterior of which is by far the longest and strongest spine of the segment; it reaches with about $1/3$ of its length beyond the end of the outer terminal spine. The posterior outer lateral spine is noticeably shorter than any of the terminal spines, but is still well developed. A. Milne Edwards and Bouvier (1900) indicate the presence of a single outer lateral spine "qui est d'ailleurs très réduite"; that this statement is incorrect is shown by the fact that in the syntypes the situation is exactly as in the Israel specimen.

The inner margin of the merus of the third maxilliped is provided with three or four very slender spines. A. Milne Edwards and Bouvier described three spines, while our Israel specimen has four; in the type material we found four as well as three spines. The ischium in our specimens (both the syntypes and the Israel male) bears only one anterior spine and not "une épine sur chacun des angles antérieurs de sa face inférieure" as described by A. Milne Edwards and Bouvier (1900, p. 289).

The fingers of the large chela in the Israel specimen do not gape in their basal part, but close over their entire length. The cutting edges of the fingers are denticulated over their full length with small denticles of different size. The upper (= outer) margin of the dactylus bears a strong spine in its extreme basal part, while both fingers have a distinct subterminal tooth on the outer margin. The palm is only slightly broader distally than proximally. The spinulation of the palm is only very superficially described by A. Milne Edwards and Bouvier, though it is well shown in the figure. The outer surface of the palm bears a longitudinal row of two to four strong spines, the anterior of which is generally placed lower than the rest; below this row, an additional row of smaller spines may be seen. A strong spine is present on the outer surface near the base of the dactylus. The upper surface of the palm bears two longitudinal rows of two to five rather small spinules, while on the inner surface also such a longitudinal row of spines is present. A squamiform sculpturation is found on the entire palm and also on the fingers. The description of the spinulation of the carpus agrees well with that given by A. Milne Edwards and Bouvier (1900); only in the third line of p. 290 in the passage "le bord qui sépare la face interne de la face supérieure" the word "supérieure" should be replaced by "inférieure". The inner surface of the merus is densely pubescent.

On the legs iridescent hairs are scattered between the usual hairs, while on the abdomen such iridescent hairs may be seen on the anterior margin of the first four somites and a few scattered over the rest of the somites.

A single damaged juvenile (cl. 3mm) of a species of *Munida* was collected off Gaza (sample 678, depth 90 m). Its condition makes it impossible to ascertain the specific identity of the animal, but it might belong to the present species.

The occurrence of *Munida curvimana* A. Milne Edwards and Bouvier in Israel waters is most interesting and unexpected, since the species had not been reported before from the Mediterranean, being known only from NW Africa (Madeira, Cape Spartel and Cape Blanco), where it was found in depths of 100-120 m.

Family PORCELLANIDAE

Porcellana longicornis (Linnaeus, 1767)

Material was collected in Haifa Bay (samples 71, 72, 231). The 8 specimens

were taken at depths between 18 and 19 m; all of them are juveniles (cl. 2 to 4 mm).

Until recently *Porcellana bluteli* Risso 1816 was incorrectly synonymized with *P. longicornis*. Zariquiey (1951) showed the two species to be perfectly distinct. All our above mentioned material belongs to the true *P. longicornis*.

The species occurs in the entire Mediterranean and in the E Atlantic between SW Norway and Mauritania (W Africa). It is also known from the Black Sea. The E Mediterranean records are: Alexandria (Balss 1936), Port Said (Balss 1927).

***Porcellana platycheles* (Pennant, 1777)**

Porcellana platycheles Steinitz 1933, p. 148; Bodenheimer 1935, p. 466; Bodenheimer 1937, p. 281; Gottlieb 1953, p. 440.

Material from Atlit, from Tantura and from rock pools near Caesarea was examined. The carapace lengths of these specimens varied between 7 and 8 mm. Steinitz (1933) reported the species from Haifa, Gottlieb (1953) from Caesarea.

Porcellana platycheles is known from the entire Mediterranean and from the E Atlantic between the Shetland Islands and the Dutch coast in the north and the Canary Islands and Cape Blanco in the south. In the E Mediterranean it has been reported from: Pylos and Methone (= Modon), S Greece (Guérin 1832), Istanbul, near Princes Islands (= Kizil Adalar), near San Stefano, near Tekirdagh (= Rodosto), near Aphisia Island, and near Gallipoli, Sea of Marmara (Ostroumoff 1896), Israel (Bodenheimer 1935, 1937), Haifa (Steinitz 1933), Caesarea, Israel (Gottlieb 1953), Port Said, Egypt (Balss 1927), near Alexandria (Balss 1936).

Section HIPPIDEA

Family ALBUNEIDAE

***Albunea carabus* (Linnaeus, 1758)**

Albunea guerinii Aharoni 1937, p. 1136; Aharoni 1944, p. 41.

Albunea carabus Gordon 1938, p. 186, figure 3b.

A female specimen (cl. 17 mm) of this species from Nabi Rubin is preserved in the collection of the British Museum (Natural History) and was examined there by Holthuis. It forms part of the material mentioned by Aharoni (1937, 1944), who found it "dans l'estuaire du Nahr Rubin". Gordon (1938, p. 186) mentioned the above specimen as originating from the "Mediterranean (shore)" and figured its eye (figure 3b).

Albunea carabus is a rare species, which in the Mediterranean is only known from Israel, the N coast of Algeria, Menorca, and Sicily. Furthermore, it has been reported from W Africa (Portuguese Guinea, Liberia and the Gold Coast).

Suborder BRACHYURA

Section DROMIACEA

Family DROMIIDAE

Dromia personata (Linnaeus, 1758) (Plate I, figure 5)

Dromia vulgaris Gottlieb 1953, p. 440.

The collection of the Haifa Sea Fisheries Research Station contains a male (cl. 68 mm) and an ovigerous female (cl. 41 mm), both collected on the Israel coast; furthermore, it possesses some specimens from Haifa Bay (samples 155, 169, 279; depths 27, 31, and 57 m, respectively), a female (cl. 18 mm) from Tira (10. IV. 1946) and a male (cl. 24 mm) from Caesarea (1952).

The present species has been indicated very often with the name *Dromia vulgaris* H. Milne Edwards, 1837, while also the name *Dromia caput-mortuum* (L. 1767) has been used for it. Linnaeus' (1758) description of *Cancer personatus* proves to be based on a specimen of the present species, so that *personatus* is the correct specific name for the species.

The species is known from the entire Mediterranean and from the E Atlantic between the S coast of England and the Gold Coast. The previous records of the species from the E Mediterranean are: S end of Bosphorus, and E coast of Aphisia Island, Sea of Marmara (Ostroumoff 1896), Rhodes (Tortonese 1947, 1947a), Cyprus (Plateau 1887), Israel (Gottlieb 1953). The Haifa Sea Fisheries Research Station possesses an ovigerous female (cl. 30 mm) from Mersin Bay, Turkey (VIII. 1954).

Family HOMOLIDAE

Homola barbata (Fabricius, 1793)

A specimen (cl. 17.5mm) was collected on 5.V.1953 at a depth of 146m, off Nabi Yunis. Two more specimens from the Israel coast (both ovigerous females, cl. 15 and 35mm) are in the collection of the Haifa Sea Fisheries Research Station.

Homola barbata inhabits the entire Mediterranean, the E Atlantic between Portugal, the Azores and the Cape Verde Islands, and the W Atlantic between Massachusetts and the West Indies; it has also been found in S African waters. E Mediterranean records are: Crete (Lucas 1853, Raulin 1870, both as *H. spinifrons*).

Section OXYSTOMATA

Family DORIPPIDAE

Dorippe lanata (Linnaeus, 1767)

Dorippe lanata Steinitz 1933, p. 148; Bodenheimer 1935, p. 466, plate 68 figure 8; Bodenheimer 1937, p. 281; Gottlieb 1953, p. 440.

The species is represented in the collections of material from the following lo-

calities: Haifa Bay (samples 54, 108, 180, 198, 209, 213, 217, 223, 243, 252, 267, 279, 289), off Atiit (sample 683), off Caesarea (sample 1004), off Nabi Rubin (depth 49 m, 29.XI.1949). This material was collected at depths between 24 and 70 m; it consists of 29 specimens, the carapace lengths of which range from 4 to 28 mm. Two ovigerous females (cl. 20 and 21 mm) were found in November (off Nabi Rubin).

Dorippe lanata inhabits the entire Mediterranean and the E Atlantic from Portugal to Angola; it has also been reported from S and SE Africa. In the E Mediterranean it has been reported from : near Chenkrèh, extreme W part of Gulf of Aigina, S Greece (Guérin 1832), Gulf of Alexandretta (= Iskenderon), Turkey (Monod 1931), Israel (Bodenheimer 1935, 1937, Gottlieb 1953), and Haifa harbour (Steinitz 1933).

***Ethusa mascarone* (Herbst, 1785)**

Six specimens (cl. 9 to 12 mm) have been collected in Haifa Bay (samples 154, 180, 191, 233, 289, 336), at depths between 31 and 79 m. The only ovigerous female (cl. 10 mm) was collected in June (sample 233).

Ethusa mascarone inhabits the entire Mediterranean and the E Atlantic between the Bay of Biscay and the Congo. On the E and W coasts of America it is represented by two different subspecies. E. Mediterranean records are : near Chenkrèh, extreme W part of Gulf of Aigina, S Greece (Guérin 1832, as *Aethusa makarone*), Khos (=Coo), Sporades (Santucci 1928), near Alexandria, Egypt (Balss 1936).

Family CALAPPIDAE

***Calappa granulata* Linnaeus, 1767) (Plate II, figure 6)**

Two specimens were taken by trawl fishing off the Mediterranean coast of Israel; one is a male (cl. 63 mm), the other a female (cl. 73 mm); the male was collected in June 1954; no exact data are known of the female.

Calappa granulata inhabits the entire Mediterranean and the E Atlantic between Portugal and the Cape Verde Islands. Previous records of the species from the E Mediterranean are : Gulf of Lakonia, S Greece (Guérin 1832), Crete (Lucas 1853, Raulin 1870), Rhodes (Tortonese 1947, 1947a), Syria (Gruvel 1928, 1931), Egypt (Gruvel 1928).

Family LEUCOSIIDAE

Subfamily LEUCOSIINAE

***Ebalia granulosa* H. Milne Edwards, 1837**

Five specimens were collected in Haifa Bay (samples 148, 260, 279, 399) at depths between 35 to 57 m. Their carapace lengths vary between 4 and 6 mm.

The specimens agree well with the descriptions given of this species, and also with the excellent figure provided by A. Milne Edwards and Bouvier (1900, plate

12, figure 4). In our material the orbits have the inner margin concave, while the posterior margin shows two distinct fissures. In the specimens of sample 279 the postero-lateral margin of the carapace is regularly rounded; it looks somewhat angular because some of the marginal granules are larger than the rest. The postero-lateral margin of the other specimens resembles that of *A. Milne Edwards* and Bouvier's figure. The dorsal tubercles of the carapace are well developed in all the specimens. In the males of samples 260 and 399, and in the female of sample 148 the two tubercles of the posterior margin of the carapace are about triangular in outline with the interspace between them about rectangular. In the specimens from sample 279 these tubercles are lower and more rounded, being separated by a rounded angle. In the male specimens the basal part of the upper surface of the telson bears a distinct triangular, proximally directed tooth, which projects over the adjoining part of the sixth segment. The upper margin of the palm of the chelae is distinctly crested, but the merus of that leg is hardly crested at all. The lower outer margin is rounded, the lower inner margin is somewhat compressed in the distal half, while the upper margin shows a long compressed tubercle in the extreme distal part with other less distinctly compressed tubercles placed behind it at irregular intervals. On the dorsal margin of the merus, carpus and propodus the ambulatory legs show the large acute tubercles, which according to Bouvier (1940, p. 207) are characteristic for the species. In the male of sample 260 such tubercles are present too on the lower margin of the propodus of the fifth leg, but they are lacking there in the female specimen of sample 279 and the male of sample 399; the male of sample 279 and the female of sample 148 lack the fifth ambulatory legs.

Until now *Ebalia granulosa* was only known from the W Mediterranean, it is reported here for the first time from the E part of that sea.

Ebalia cranchii Leach, 1817

A male (cl. 4.5 mm) was collected in Haifa Bay (sample 263, depth 55 to 57 m) and a juvenile female (cl. 3 mm) off Caesarea (sample 698, depth 54 m).

The tubercles of the carapace in these specimens are less well developed than in the *E. granulosa* specimens, though all are distinct. The crest on the palm of the cheliped is lower and less distinct, the dorsal teeth of the merus are low and not compressed. The ambulatory legs are evenly granulate and do not show the large pointed granules found in *E. granulosa*. Still, all these differences are only gradual and we cannot escape the impression that the two species might just be representing the extreme forms of a single variable species. The tooth of the telson in the male specimen of *E. cranchii* is less distinct than in our *E. granulosa* males.

Ebalia cranchii is known from the entire Mediterranean and from the E Atlantic between Norway and Senegal. Ostroumoff (1896) reported it from near Marmara Island, Sea of Marmara.

***Myra fugax* (Fabricius, 1798) (Plate II, figure 7)**

Myra fugax Monod 1930, p. 140, figure 8; Monod 1931, p. 427; Monod 1932, p. 68, figure; Bodenheimer 1935, p. 466; Bodenheimer 1937, p. 281; Gottlieb 1953, p. 440; Wirszubski 1953, p. 17.

Material of this species has been examined from: Haifa Bay (samples 54, 56, 77, 95, 108, 135, 148, 149, 151, 165, 167, 179, 180, 239, 243, 245, 252, 265, 267, 269, 270, 271, 283, 291, 303, 305, 307, 308, 344), off Atlit (sample 694), off Caesarea (sample 1004), off Natanya (sample 844), off Nabi Rubin (sample 1028). The material was obtained from depths between 18 and 100 m; it consists of a large number of specimens, the carapace lengths of which range from 4 to 38 mm; no ovigerous females were observed.

Bodenheimer's (1935, p. 466) remark that the fourth pair of legs of this species is modified to carry sponges etc. on the back of the animal is not correct. None of the legs of *Myra* is modified for this purpose, and the carapace practically always is entirely free from growths.

Myra fugax originally inhabits the Indo-West Pacific region, where it is found from the Red Sea, E and SE Africa eastwards to Japan, the Malay Archipelago and New Caledonia. Through the Suez Canal it has entered the E Mediterranean, where it has become well established by now. Calman (1927) and Fox (1927) reported the species from the Suez Canal between Lake Timsah and Port Said; Monod (1937, 1938) also recorded specimens from the Canal. The first record of *Myra* from the E Mediterranean is that by Monod (1930, 1931, 1932), who reported on three male specimens collected in April 1929 south of Jaffa, Israel, on a muddy bottom at a depth of 40 to 50 m; the same author (Monod 1930, 1932) mentioned the occurrence of the species in the Gulf of Alexandretta (= Iskenderon), Turkey, although he had not examined material from there. Later records from the E Mediterranean are: Israel (Bodenheimer 1935, 1937, Gottlieb 1953, Wirszubski 1953), near Alexandria, Egypt (Balss 1936).

***Leucosia signata* Paulson, 1875 (Plate II, Figure 8)**

Leucosia signata Holthuis 1956, p. 318.

A female (cl. 19 mm) was collected in June 1953 at Bat Yam (coll. Tel Aviv Institute of Natural Science). It agrees very well with the descriptions and figures given in the literature. The colour pattern on the carapace (a roughly M-shaped brown figure in the anterior half and two submedian spots in the posterior third) is still visible. The dactyli, propodi and carpi of the ambulatory legs show a brown band in their basal part, while in the meri such a band is visible in the distal region. In the thoracic sinus the row of granules that is placed just over the base of the cheliped has the anterior three granules far larger than the posterior three. The first granule is elongate and distinctly longer than the second.

Leucosia signata inhabits the entire Red Sea and also has been reported from Zanzibar. It proves to be quite numerous in the Suez Canal from where it has been reported by several authors (Calman 1927, Fox 1926, 1927, Gruvel 1936, Monod 1937, 1938, Holthuis 1956). Apart from Holthuis' (1956) remark that the species is found in Israel, it is now reported from the Mediterranean for the first time.

Subfamily ILIINAE

Ilia nucleus (Linnaeus, 1758)

A male (cl. 10 mm) was collected in Haifa Bay (sample 54, depth 27 to 33 m).

Ilia nucleus inhabits the entire Mediterranean and the E Atlantic between Morocco and the Cape Verde Islands. Records from the E Mediterranean are: Methone (= Modon) Bay, S Greece (Guérin 1832), near Princes Islands (= Kizil Adalar) and near Tekirdagh (= Rodosto), Sea of Marmara (Ostroumoff 1896, as *Ilia rugulosa*), near Alexandria, Egypt (Balss 1936).

Section BRACHYRHYNCHA

Family PIRIMELIDAE

Pirimela denticulata (Montagu, 1808)

Pirimela denticulata Steinitz, 1933, p. 149; Bodenheimer, 1937, p. 281.

A female (cl. 7.5 mm) was examined. It was collected on 8.X.1953 near Tantara by A. Abulafia (coll. Institute of Natural Sciences, Oranim). Steinitz (1933) reported *Pirimela* from Haifa. Bodenheimer's (1937) Israel record evidently is based on that by Steinitz.

The species inhabits the entire Mediterranean and the E Atlantic between the W coast of Norway and the Cape Verde Islands. The only record from the E Mediterranean, other than by Steinitz, is given by Balss (1936, pp. 31-32) who reported on material from near Alexandria. The species has once been reported from Suez, but has been found neither in the Suez Canal nor in other parts of the Red Sea.

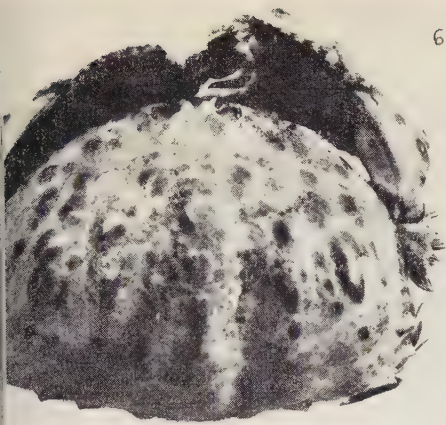
Family PORTUNIDAE

Carcinus mediterraneus Czerniavsky, 1884

Carcinides maenas Steinitz 1933, p. 149; Bodenheimer 1935, p. 466, plate 68 figure 6; Bodenheimer 1937, p. 281.

Carcinus maenas Carmin 1955, p. 3.

Material was examined from the following Israel localities: Haifa harbour (19.X.1954), Alexander River, between Caesarea and Natanya (12.IV.1955), near Natanya (trawled, 4.VIII.1946), Tel Aviv (16.IX. 1930, leg. J. Carmin), Israel coast



6

FIGURE 6

granulata (Linnaeus). Animal in dorsal view.



7

FIGURE 7

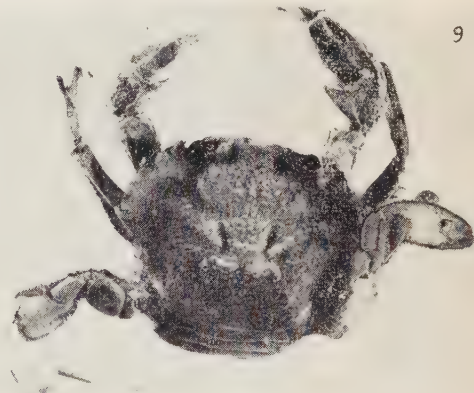
Myra fugax (Fabricius). Animal in dorsal view.



8

FIGURE 8

signata Paulson. Animal in dorsal view.



9

FIGURE 9

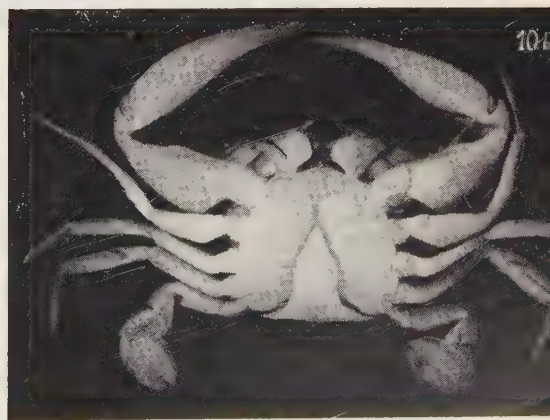
Macropipus depurator (Linnaeus). Animal in dorsal view.



10a

FIGURE 10a

poissonii (Audouin). Male in dorsal view.



10b

FIGURE 10b

Thalamita poissonii (Audouin). Male in ventral view.

(leg. J. Carmin). These six specimens have carapace lengths ranging from 11 to 26 mm. The Haifa specimen has the carapace covered with Balanids. Steinitz (1933) observed the species in Haifa Bay, where he noted it to be rather abundant in early spring and to become scarcer later in the year. An ovigerous female was collected by Steinitz in the first half of March. Carmin's (1955) record is based mainly on the above mentioned specimens of the Carmin collection.

Until very recently only one species of the genus *Carcinus* Leach was recognized; this species being named *C. maenas* (L.). Demeusy & Veillet (1953) were the first to point to certain differences found between Atlantic and Mediterranean populations of *Carcinus maenas* (L.). During a recent meeting in Barcelona (July 1957), four carcinologists (Drs. Isabella Gordon, R. Zariquiey, J. Forest and L. B. Holthuis) looked into this question and found some constant differences in the shape and granulation of the carapace and in the pleopods of Atlantic and Mediterranean specimens of *Carcinus* (Forest, 1957a, p. 423). There can be little doubt that two species are involved here. In the original description of *Cancer maenas* Linnaeus there is nothing to show which of the two species of *Carcinus* was before Linné, while the type locality given by him is "in Oceano Europaeo, Asiatico" (Linnaeus, 1758, p. 627). Linné's references to previous authors are "It. wgoth. 173. Rumph. mus t. 6. f. o. Pet. amb. t. 1. f. 5." The figure in Rumphius' *Rariteitkamer*, of which that published by Petiver is a mere copy, is not made after an Amboinese specimen as has often been supposed, but has been added later, being made after a specimen from a Dutch collection; the origin of this specimen is unknown. The specimen described in Linnaeus' (1747) *Wästgöta-Resa* (p. 173) was collected on the westcoast of Sweden at Marstrand, N. of Göteborg. It is this locality that we now select as the restricted type locality for *Cancer maenas* L. By this action the name *maenas* becomes the correct specific name for the Atlantic *Carcinus* species. The first valid name for the Mediterranean species, to our knowledge, is *mediterranea* Czerniavsky, 1884. Czerniavsky (1884, p. 177), namely, divided *Carcinus maenas* into two varieties: *mediterranea* and *septentrionalis*. By bringing the Mediterranean and Black Sea specimens of *Carcinus* to the first variety, he evidently reserved the second for the Atlantic form. Both the names *mediterranea* and *septentrionalis* fall in the subspecific category (cf. 1950, Bull. zool. Nomencl., vol. 4, p. 91, Concl. (7) (a) (ii)) and therefore are available for the nomenclature of species and subspecies. The name given by Czerniavsky to several forms of *Carcinus maenas mediterranea*, namely *pontica* (*gigantea*), *sublaevis*, and *subtomentosa* are infra-subspecific and thus are not available for the nomenclature on the species and subspecies level. The specific name *septentrionalis* Czerniavsky falls as a subjective synonym of *maenas* L., the specific name *mediterranea* should be used for the mediterranean species of *Carcinus*, the name of which thereby becomes *Carcinus mediterraneus* Czerniavsky. Costa (1840, p. 1) mentioned *Carcinus maenas laevigatus* from Naples, but since he did not give any indication with

this name, it must be considered a *nomen nudum* and cannot be used for the present species, though Costa's specimens very probably belong here.

The fact that the two *Carcinus* species have not been distinguished by previous authors makes it extremely difficult to indicate the exact range of distribution of each. The genus has been reported from the entire Mediterranean, the Black Sea, the eastern Atlantic from northern Norway to Mauritania, the east and west coast of America (Nova Scotia to Virginia, Brazil, Panama), and the Indo-West Pacific region (Red Sea, Ceylon, Australia, Hawaii). *C. maenas* is known with certainty from the Atlantic coasts of Europe and North America, *C. mediterraneus* from the entire Mediterranean. The records of the latter species from the E Mediterranean are: Gulf of Lakonia and Aigina, S Greece (Guérin 1832), Phaleron Bay near Athens, Greece (Athanasopoulos 1917), Istanbul (Ninni 1923, Rathbun 1930), Bujuk-Cekmece, Sea of Marmara (Ostroumoff 1896), Soudha, NW Crete (Lucas 1853, Raulin 1870), Israel (Bodenheimer 1935, 1937, Carmin 1955), Haifa, Israel (Steinitz 1933), Egypt (Audouin 1826), near Port Said (Calman 1927, Rathbun 1930, Gruvel 1936), Suez Canal (Calman 1927, Fox 1927, Gruvel 1936, Monod 1937, 1938), near Alexandria (Balss 1936), Cairo market (Monod 1938), Derna, Cyrenaica (Colosi 1923). The Leiden Museum possesses two specimens from Port Said (VI.1923 and I.I.1928, leg P. Buitendijk). In the U.S. National Museum the material from Istanbul (date unknown, G.P. Marsh; VII.1922, III, IX., X. 1923, H.C. Kellers), and Port Said (VII.1922, H. C. Kellers) reported on by Rathbun (1930) was examined.

***Portumnus latipes* (Pennant, 1777)**

Portumnus latipes Gottlieb, 1953, p. 440.

Two specimens (cl. 12 and 17 mm) were collected near Naaman, N. of Haifa (25.IV.1955) and near the Alexander river between Caesarea and Natanya (20. XII. 1955).

Portumnus latipes is known from the entire Mediterranean and from the Black Sea; it furthermore inhabits the E Atlantic from the North Sea southwards to Morocco and the Azores. E Mediterranean records are: Soudha, NW Crete (Lucas 1853, Raulin 1870), Israel (Gottlieb 1953), Gamileh near Port Said, Egypt (Calman 1927), near Alexandria, Egypt (Balss 1936).

***Xaiva biguttata* (Risso, 1816)**

A male specimen (cl. 9 mm) was collected on 12.VII. 1950 at Tantura (coll. Tel Aviv Institute of Natural Science). It agrees perfectly with the published descriptions.

Xaiva biguttata inhabits the entire Mediterranean and the E Atlantic from the S coast of England to S Africa. The only previous E Mediterranean record known

to us is by Athanassopoulos (1917), who reported the species under the name *Platyonichus nasutus* Latr. from Phaleron Bay near Athens, Greece.

Macropipus parvulus Parisi, 1915)

Material has been examined from: Haifa Bay (samples 108, 127, 149, 154, 199, 241, 267, 279, 360, 385), off Atlit (sample 509), off Natanya (sample 983), off Herzliya (sample 568), off Tel Aviv (samples 524, 527). The material was collected at depths between 30 and 59 m; it consists of 33 specimens, the carapace lengths varying between 4 and 10 mm; the three ovigerous females (cl. 6 to 9 mm) were collected in March and June (samples 108, 360, and 527). The male of sample 241 is parasitized by a species of *Sacculina*.

Recently Zariquiey (1955) showed that in Mediterranean material reported upon as *Portunus pusillus* two species actually are represented. To these species he gave the names *Macropipus pusillus* (Leach) and *M. parvulus* (Parisi). These names are employed here in the sense adopted by Zariquiey, though recent, but still unpublished, studies by Dr. Isabella Gordon of the British Museum (Nat. Hist.) seem to point to the necessity that one or both species ought to be renamed.

At present *M. parvulus* is known with certainty only from NE Spain, from Italy (Naples) and from Israel.

Macropipus pusillus (Leach, 1815)

Portunus pusillus Gottlieb 1953, p. 440.

Two specimens (cl. 7 and 9 mm) were collected in Haifa Bay at depths of 18 and 19 m (samples 52 and 280). These specimens agree very well with Zariquiey's (1955) description and figures, especially in the shape of the front, the antero-lateral teeth of the carapace, the chelipeds and the pereopods. All the walking legs have a dark spot on the merus, the propodus and the base of the dactylus, while the base of the fingers of the chela also shows a dark coloration. The carapace is rather dark with a longitudinal median light zone which is narrowest in the middle; furthermore, there are light coloured regions near the antero-lateral margin of the carapace.

The species occurs throughout the Mediterranean and is also known from the E Atlantic between W Norway and W Africa. Records from the E. Mediterranean are: Sporades, 37° 37'N 26° 58'E (Adensamer 1898), Khos (=Coo), Sporades (Santucci 1928), Israel (Gottlieb 1953). Since the distinctness of *M. parvulus* and *M. pusillus* has been recognized only recently, it is not certain whether the above records actually pertain to the present form.

Macropipus vernalis (Risso, 1816)

Fifteen specimens (cl. 5 to 14 mm) were examined. They were collected in Haifa Bay (samples 108, 198, 217, 220, 223, 411; depth 24 to 35 m) and off Rafah

(sample 544, depth 23 m). The only ovigerous female (cl. 11 mm) of this material was collected in May (sample 411). A male (cb. 21 mm) from the Israel coast (leg. I. Aharoni, 1920) is preserved in the collection of the British Museum (Natural History).

The systematic status of several of the species of *Macropipus* inhabiting the Mediterranean has not been understood correctly by most authors. The present species has often been confused with *M. marmoreus* (Leach 1814), *M. bolsatus* (Fabricius 1798), *M. depurator* (Linnaeus 1758) or *M. bolivari* (Zariquiey 1948). Zariquiey (1948), who dealt with the present species under the name *Portunus bolsatus*, indicated its differences from *M. bolivari* and *M. depurator*. Later the same author (Zariquiey 1952) enumerated the differences between it and the true *M. bolsatus*.

The present species has been described as new by various authors, but, as stated above, the status of these "new" species has never been correctly understood. The oldest description we know of is that by Risso (1816, p. 27), who described the species as *Portunus vernalis*. Risso's diagnosis runs as follows: "Testa levi, griseo-pallida; fronte quinquedentata, dentis inaequalibus; carpis interne bispinosis." In Risso's specimen the short hairs of the carapace evidently are rubbed off so that the latter is smooth and naked. In the present species the front is not at all produced forward so that its three teeth are placed almost in one row with the inner orbital teeth, which at the same time makes the latter more prominent. This arrangement evidently led Risso to state that the front consists of 5 teeth. In the description Risso indicated the carpus of the chelipeds as "triangulaire, cilié d'un côté, muni d'une pointe de l'autre" which does not check with his diagnosis "carpis interne bispinosis", but very well describes the situation in the present species; evidently the statement in the diagnosis is incorrect. Also the habitat of *Portunus vernalis* "Galets de notre plage" fits very well for the present species. Risso's measurement of 0.010 m for the length obviously is an error and should be 0.018 or 0.019. The characters given by Risso for his species, and especially the smoothness of the carapace, the shape of the front and the habitat, leave very little room for doubt that the present species actually is meant. Much more extensive and exact is Cocco's (1833, p. 107, figure 1) account of his new *Portunus valentieni* of which a good description and figure are given, which leave not the least doubt as to the identity of this species with the present one. In 1837 the species was described as new for the third time when Rathke (1837, p. 355, plate 3, figures 1-3) published the description and figures of his *Portunus dubius*. Like Risso, Rathke stated the front to consist of 5 teeth; his figure shows that the inner orbital angles are included in this number. Rathke's description and figures clearly show the identity of his species. Finally, Lucas (1846, p. 15, plate 2 figure 2) described and figured the present species under the name *Portunus barbarus*. Lucas' description and figure are excellent and distinctly show that *P. barbarus* is identical with the present species. In Lucas' figure the front is incorrectly shown with 4 instead of with 3 teeth, but

this evidently is due to an error of the artist : in the types, one of which could be examined in the Philadelphia Academy of Natural Sciences, the front actually bears the normal number of teeth.

The specimens from Port Said, identified by Calman (1927, p. 212) as *Portunus bolsatus* Fabr., were examined by Holthuis in the British Museum (Natural History) and proved to belong to *Macropipus vernalis*.

Macropipus vernalis until now is known with certainty from W Africa (Rio de Oro), Spanish Morocco (Mellilla), Algeria (Oran and Argelia), NE Spain (Rosas and Cadaqués), S France (Banyuls), Italy (Naples), Israel and Egypt (Port Said).

Macropipus depurator (Linnaeus, 1758) (Plate II, figure 9)

Portunus depurator Steinitz 1933, p. 149; Bodenheimer 1935, p. 466; Bodenheimer 1937, p. 281; Gottlieb 1953, p. 440.

Portunus corrugatus Gottlieb 1953, p. 440.

Three Israel specimens have been examined by us. One damaged specimen (cl. 11 mm) was collected in Haifa Bay (sample 213, depth 38 m, 17.V.1955), an ovigerous female (cl. 28 mm) was trawled off Nabi Yunis (depth 146 m), while the collection furthermore contains a female (cl. 22 mm) from the Mediterranean coast of Israel (20.III. 1952) without more accurate locality data. Steinitz (1933) stated that the species belongs to the common crabs near Haifa and that ovigerous females are observed in March and April. It is possible that Steinitz did not distinguish this species from *M. vernalis* (Risso), which seems to be the commoner of the two species.

Macropipus depurator inhabits the entire Mediterranean and has also been reported from the Black Sea. Furthermore, it is known from the E Atlantic between the W coast of Norway and Rio de Oro (W Africa). E Mediterranean records are : Greece (Athanasopoulos 1917, as *Portunus plicatus*), near Princes Islands (=Kizil Adalar), near Tekirdagh (= Rodosto), and near the S coast of Marmara Island, Sea of Marmara (Ostroumoff 1896), Rhodes (Tortonese 1947), Israel (Bodenheimer 1935, 1937, Gottlieb 1953), Haifa, Israel (Steinitz 1933), near Alexandria, Egypt (Balss 1936).

Charybdis hellerii (A. Milne Edwards, 1867)

Charybdis (*Goniosoma*) *merguiensis* Steinitz 1929, p. 79; Monod 1930, p. 140, figure 7; Monod 1931, p. 428, figure 23; Monod 1932, p. 68, figure.

Charybdis merguiensis Steinitz 1933, p. 151; Bodenheimer 1935, p. 466; Bodenheimer 1937, p. 281; Gottlieb 1953, p. 440.

Charybdis hellerii Leene 1938, p. 44.

Three specimens (cl. 13 to 16 mm) were collected in Haifa Bay (samples 154, 165), at depths between 31 and 38 m. Furthermore, we examined two specimens (cl. 13 and 14 mm) from Haifa harbour (1.XII.1954, coll. Institute of Natural

Sciences, Oranim) and one specimen (cl. 34 mm) from the Israel coast (coll. Tel Aviv Institute of Natural Science). The species was recorded for the first time from Israel by Steinitz (1929, 1933); his material consisted of two juvenile males (cl. 16 mm) from Haifa. Monod (1930, 1931, 1932) described and figured a male, which was collected in April 1929 S of Jaffa at a depth of 40 to 50 m on a muddy bottom.

Leene (1938, p. 44) showed that correct name of this species is not *C. merguensis* (De Man 1887), but *C. hellerii* (A. Milne Edwards 1867).

The species is of Indo-West Pacific origin, inhabiting there the region between the Red Sea, Madagascar, the Malay Archipelago, New Caledonia and Queensland. It must have entered the E Mediterranean through the Suez Canal, though it has not yet actually been taken in the Canal. E Mediterranean records are: Israel (Bodenheimer 1935, 1937, Gottlieb 1953), Haifa Bay (Steinitz 1929, 1933), S of Jaffa, Israel (Monod 1930, 1931, 1932), near Alexandria, Egypt (Balss 1936).

***Charybdis sexdentata* (Herbst, 1783)**

Charybdis (*Goniosoma*) *sexdentata* Steinitz 1929, p. 78.

Charybdis sexdentata Steinitz 1933, p. 150; Bodenheimer 1935, p. 466; Bodenheimer 1937, p. 281.

Steinitz (1929, 1933) mentioned a specimen (cl. 46 mm) which was caught near Haifa and which he identified with Herbst's species. Since the name *sexdentata* has been applied to several different species of *Charybdis*, it is not possible, without reexamination of Steinitz' material, to know with certainty the identity of his specimen. Bodenheimer's (1935, 1937) records evidently are based on those by Steinitz.

***Thalamita poissonii* (Audouin, 1826) (Plate II, figure 10a, b)**

We examined four males (cl. 9 to 14 mm) and one female (cl. 9 mm) from the shore of Haifa Bay between Kishon and Naaman rivers (17.II.1956) and one male (cl. 16 mm) from Bat Yam (10.VIII.1952, coll. Tel Aviv Institute of Natural Science).

The specimens agree extremely well with the account given by Stephensen (1945) of this species, at least as far as concerns the shape of the front, the chelipeds, the swimming legs, the male abdomen and the male pleopods. In all our specimens, however, the four transverse ridges in the meta-branchial region of the carapace are distinct and arranged as in Savigny's (1817) figure.

Thalamita poissonii is an Indo-West Pacific species, which is known from the Red Sea, the Iranian Gulf, the W Indian Ocean (Laccadive Islands, Chagos Archipelago, Saya de Malha, Ceylon) and Formosa. It is now reported for the first time from the Mediterranean, having evidently arrived there by way of the Suez Canal, whence it was reported by Calman (1927).



FIGURE 11
Callinectes sapidus Rathbun. Animal in dorsal view.



FIGURE 12
Portunus pelagicus (Linnaeus). Animal in dorsal view.



FIGURE 13
Pseudosquilla verrucosa (Forsk.) Animal in dorsal view.



FIGURE 14
Ocypode cursor (Linnaeus). Animal in dorsal view.



FIGURE 15
Grapsus marmoratus (Fabricius). Animal in dorsal view.



FIGURE 16
Maja goltziana Oliveira. Animal in dorsal view.

Callinectes sapidus Rathbun, 1896 (Plate III, figure 11)

Callinectes sapidus Holthuis and Gottlieb 1955, p. 154.

Numerous specimens (cl. 6 to 90 mm) were found in Israel; they were collected at the following localities: Israel coast, mouth of Naaman river near Acre (III. —X.1955, coll. A. Perlmutter), Haifa Bay (28.X.1955), mouth of Daliya river near Tantura, about halfway between Caesarea and Atlit (26.X.1955, coll. A. Perlmutter), mouth of Heftsi-Bah river near Hadera (21.XI. 1951). This material has already been dealt with by Holthuis and Gottlieb (1955). Furthermore, a juvenile (cl. 15 mm) from the Alexander river near its mouth between Caesarea and Natanya (20.XII.1955) was studied. Ovigerous females were found in October.

Callinectes sapidus inhabits the E coast of America from Nova Scotia to Uruguay. It has been introduced into European waters where seven specimens were found alive between 1900 and 1951 in Italy, France, Holland and Denmark. The French, Dutch and Danish specimens have already been discussed at some length by Holthuis and Gottlieb. Both the Italian animals were collected near Venice (a female, cl. 75 mm, cb. 180 mm in sea near Caorle, N of Venice on 7.XII.1949, and a male, cl. 80 mm, cb. 190 mm, in the lagoon of Venice near Fusina, 19.X.1950). They were reported on by Giordani Soika (1951, pp. 18-20), who identified them as *Neptunus pelagicus*. Giordani Soika's figure and his extensive colour description, however, show his specimens to be *Callinectes sapidus*. The records of the present species from WAfrica cannot be trusted (see Monod 1956, p. 204).

Portunus hastatus (Linnaeus, 1767)

Neptunus hastatus rubromaculata Steinitz 1932a, p. 133; Steinitz 1933, p. 150; Bodenheimer 1937, p. 281.

Five specimens (cl. 3.5 to 16 mm) were collected: Mediterranean coast of Israel, Haifa Bay (samples 270, 308), off Atlit (sample 693), Caesarea (rock pools, 21.XI.1951). The material was obtained at depths between 18 and 33 m. The two ovigerous females of this collection have a carapace length of 16 mm; the season in which they were collected is unknown. The specimen of sample 270 is a juvenile with cl. 3.5 mm; due to its small size, its identity could not be fully ascertained. The Caesarea specimen has a carapace length of 13 mm. Steinitz (1932, 1933) reported the present species from shallow water in Haifa harbour.

Portunus hastatus is known from the entire Mediterranean and from the W African coast down to Angola. The records from the E Mediterranean are: Greece (Athanassopoulos 1917), Gulf of Lakonia and Aigina, S Greece (Guérin 1832, as *Portunus Dufourii*), Rhodes (Tortonese 1947), Cape Kephala, Anatolia, Turkey (Santucci 1928), St. Georges Bay, Beirut, Lebanon (Monod 1931), Israel (Bodenheimer 1937), Haifa, Israel (Steinitz 1932, 1933), Alexandria, Egypt (Balss 1936).

Portunus pelagicus (Linnaeus, 1758) (Plate III, figure 12)

Neptunus (Portunus) pelagicus Fox 1924, p. 714.

Neptunus pelagicus Fox 1926, p. 4; Fox 1927, p. 217; Steinitz 1929, p. 78; Steinitz 1933, p. 150; Bodenheimer 1935, p. 466, plate 68, figure 7; Bodenheimer 1937, p. 281; Gottlieb 1953, p. 440; Carmin 1955, p. 3.

Portunus pelagicus Holthuis and Gottlieb 1955, p. 155.

The collection of the Haifa Sea Fisheries Research Station contains material from: Haifa Bay (sample 165, dredge, depth 37—38 m, 30.XI.1954; beach seine, X. 1955), and mouth of Heftsi-Bah river near Hadera (21.XI.1955). The carapace lengths of these four specimens range from 13 to 68 mm. The species is very common in trawl and beach seine catches made on the Israel coast and, as already noted by Steinitz (1933), it has a high commercial value. In the literature it has been reported from the following Israel localities: Israel (Bodenheimer 1935, 1937, Carmin 1955), Haifa (Fox 1924, 1926, 1927, Steinitz 1929, 1933, Holthuis and Gottlieb 1955), rock pools at Caesarea (Gottlieb 1953), mouth of Heftsi-Bah river (Holthuis and Gottlieb 1955).

Portunus pelagicus is widely distributed throughout the Indo-West Pacific region where it is known from the Red Sea and SE Africa to Japan, the Malay Archipelago and Tahiti. Through the Suez Canal it has migrated into the E Mediterranean. The first specimen was observed in the Suez Canal (Bitter Lakes) in 1886 (Krukenberg, 1888); later reports are those by Fox (1924, 1926, 1927), Calman (1927), Gruvel (1936), Monod (1937, 1938), Tortonese (1947b, 1952) and Holthuis (1956). Fox gave quite an accurate account of the speed with which the species advanced through the Canal. It was observed for the first time in the E Mediterranean in 1898, when it was seen in Port Said. The E Mediterranean records (other than those from Israel) are: Gulf of Alexandretta (=Iskenderon), Turkey (Gruvel 1928, 1929, 1930, 1931, Monod 1930, 1931, 1932), Syria (Gruvel 1930, 1931), Beirut, Lebanon (Steinitz 1929, 1933, Balss 1936, Bouvier 1940), Port Said, Egypt (Fox 1924, 1926, 1927, Calman 1927), Alexandria (Fox 1924, 1926, 1927, Balss 1936), Mersa Matruth, Egypt (Fox 1924). Fox (1924, 1927) remarked that in 1924 *Portunus pelagicus* had not yet reached Beirut, while Tortonese (1947) stated that the species does not occur in Rhodes. The specimens reported from near Venice, Italy by Giordani Soika (1951), as *Neptunus pelagicus* prove to belong to *Callinectes sapidus* Rathbun (see p. 91). The collection of the U.S. National Museum, Washington, D.C., possesses a female of this species (cb. 69 mm, cl. 30 mm) collected in the sea at Hatay, Iskenderon, Turkey (13.VIII. 1954, W. H. Wells and B. H. Randall).

Family XANTHIDAE

Xantho poressa (Olivi, 1792)

Xantho hydrophilus Steinitz 1933, p. 152; Bodenheimer 1935, p. 468; Bodenheimer, 1937, p. 281; Gottlieb, 1953, p. 440.

Material of this species was examined from the following localities: Haifa Bay (samples 98, 245), Atlit, Tantura, Caesarea (rock pools, VI.1946) and Bat Yam. The Haifa specimens were collected at depths of 22 and 29 m, respectively. The carapace lengths of the specimens varied between 4.5 and 23 mm; in two ovigerous females it was 11 and 11.5 mm, respectively.

Xantho poressa is also known under the names *Xantho hydrophilus* (Herbst 1790) and *Xantho rivulosus* (Risso 1816), both of which are incorrect (see Holthuis 1954). The systematics of this and related species of the genus have been dealt with extensively by Drach and Forest (1953).

The species inhabits the entire Mediterranean, the Black Sea and the Canary Islands. The records from the E Mediterranean are: Navarino Bay, Methone (=Modon) and Sapienza, S Greece (Guérin 1832, as *Cancer cinereus*), Phaleron Bay near Athens (Athanasopoulos 1917), Bosporus (Heller 1863), Istanbul fishmarket (Ninni 1923), near Gallipoli, Sea of Marmara (Ostroumoff 1896), near Khandia, NW Crete (Lucas 1853, Raulin 1870), Rhodes (Santucci 1928, Tortonese 1947), Cyprus (Heller 1863), Lebanon (Drach and Forest 1953), Sidon (=Saida), Lebanon (Monod 1931), Israel (Bodenheimer 1935, 1937), Haifa (Steinitz 1933), Caesarea, Israel (Gottlieb 1953), Egypt (Audouin 1826), Port Said (Calman 1927), near Alexandria, Egypt (Balss 1936). In the U.S. National Museum, Washington, D.C., two specimens of this species from Istanbul (IX., X. 1923, H. C. Kellers) were examined.

***Xantho granulicarpus* Forest, 1953**

Xantho? floridus Gottlieb, 1953, p. 440.

Material from the following localities has been examined: Haifa Bay (samples 98, 121, 138, 195, 385), Tantura (7.VII.1952 and 5.VII.1955, coll. Tel Aviv Institute of Natural Science), Caesarea (rock pools, 16.VII. and 23.X.1952). The Haifa specimens were collected at depths between 18 and 46 m. The carapace lengths of the twelve specimens examined vary between 5 and 14 mm. Ovigerous females (cl. 9 and 10 mm) were collected in the months of April and June (samples 98, 195).

Xantho granulicarpus has for a long time been confused with *Xantho incisus* Leach (=X. *floridus* auct., non *Cancer floridus* L.). Drach and Forest (1953) in their revision of the European *Xantho* species showed it to be a distinct form.

Xantho granulicarpus is known from the entire Mediterranean, but far as known to us it has not been encountered elsewhere. The records from the E Mediterranean are: Istanbul fishmarket (Ninni 1923), Páros, Cyclades (Drach and Forest 1953), Israel (Gottlieb 1953), Alexandria, Egypt (Balss 1936), Benghazi, Cyrenaica (Colosi 1923). The Rijksmuseum van Natuurlijke Historie possesses material of this species from Benghazi, Cyrenaica (rocky and sandy shore, XI.1951, C. Beets).

Micropanope rufopunctata (A. Milne Edwards, 1869) (Figure 15)

A male (cl. 3.5mm) was collected in Haifa Bay (sample 390, depth 18 m). It shows some minor differences from the description and figures given by A. Milne Edwards and Bouvier (1900, p. 87, plate 16 figures 6—13) of *Xanthodes granosus*. The two inner lobes of the front have the anterior margin less distinctly convex than in the figure of the type, and the median incision of the front is deeper. The

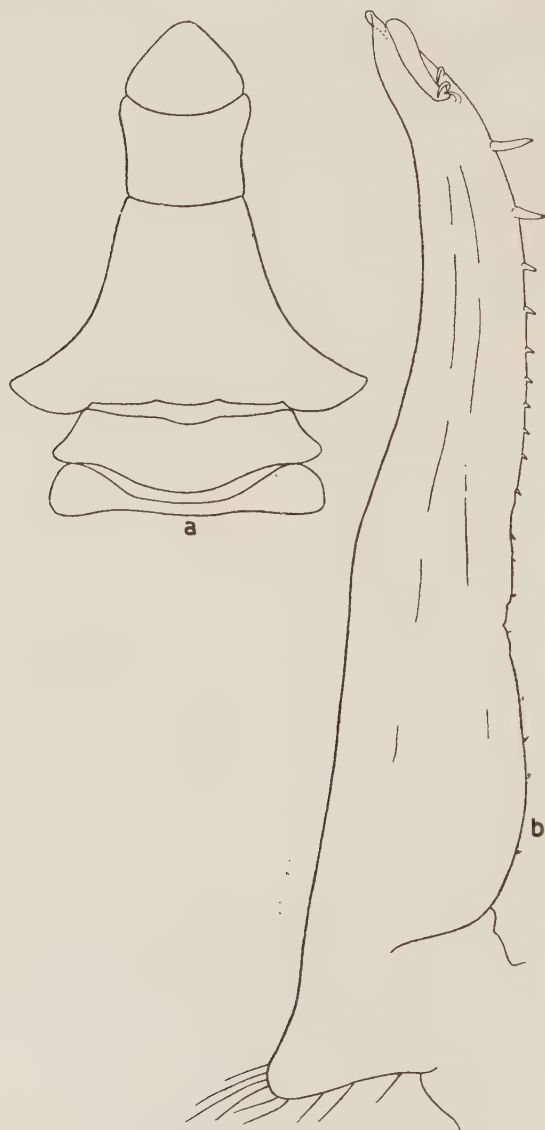


FIGURE 15.

Micropanope rufopunctata (A. Milne Edwards). a, abdomen of male; b, right first pleopod, posterior view. a, $\times 28$; b, $\times 50$.

external lobes of the front, which are at the same time the inner orbital angles, are sharply set off from the median lobes and distinctly placed more backwards. The four antero-lateral teeth, are more distinctly pointed than in the figure cited above. The granule pattern on the carapace is well shown by A. Milne Edwards and Bouvier. The larger chela of the male has the entire outer surface of the palm tuberculated; this tuberculation extends up to the base of the fixed finger. The inner surface is smooth or only slightly tuberculate, except for the upper portion where distinct tubercles may be seen. The dark colour of the fingers does not extend on the palm; the finger tips are slightly paler than the rest. The upper anterior margin of the carpus is crenulated or serrated, the inner of these crenulations or serrations being larger than the rest; the upper inner margin shows a distinct spine-like tooth. The smaller first leg and the walking legs (only one of the latter is present in our material) strongly resemble A. Milne Edwards and Bouvier's figures. The merus of the walking leg of our specimen has small tubercles on the lower margin. The first pleopod of our male is curved slightly outwards; the inner margin bears some spinules which increase in size distally; three strongly curved sharply pointed spines are placed near the lower part of the distal opening; the tip of the pleopod ends in some lobes. It agrees quite well with Monod's (1956) figure 392. The second segment of the male abdomen is angularly produced in the proximal half of its lateral margin as described by A. Milne Edwards and Bouvier. The sixth segment slightly broadens anteriorly, while the last segment is triangular with broadly rounded angles.

It is possible that the present specimen is not yet fully grown. A. Milne Edwards and Bouvier report on a male with cl. 7 mm, but have also small males (cl. 3 mm) in their collection; in these smaller specimens the front is straighter than in the large ones, which agrees very well with the observation made on the Israel male. Balss (1936) mentioned specimens of this species with cl. up to 12 mm; an ovigerous female in his material had a carapace length of 5.3 mm.

The species was originally placed in the genus *Xanthodes* Dana, while Balss (1936) used the generic name *Xanthias* Rathbun for it. However, the facts that the first legs are strongly unequal, that the median frontal lobes are sharply separated from the inner orbital angles and that the frontal lobes are not convex, show that the species cannot be maintained in the genus *Xanthias* as restricted by Odhner (1925, p. 84). Monod (1933, p. 65) referred *Xanthodes granosus* A. Milne Edwards and Bouvier doubtfully to the genus *Micropanope* Stimpson 1871. In a recent publication the same author (Monod 1956, p. 313) confirmed his opinion of 1933 and at the same time showed that the name *Xanthodes rufopunctatus* A. Milne Edwards, 1869, is synonymous with *Xanthodes granosus* A. Milne Edwards and Bouvier, 1898, so that the correct name of the species becomes *Micropanope rufopunctata* (A. Milne Edwards 1869). A comparison of our material with specimens of *Micropanope* does not leave any doubt that Monod is correct

and it is even doubtful whether the species is distinct from *Micropanope granulimanus* (Stimpson 1871), a species known at present from the Bahamas, Cuba and Curacao. Our material is too small, however, to permit a decision in this question to be made.

Micropanope rufopunctata is known from W Africa (Azores, Canary and Cape Verde Islands, Gold Coast) and from the E Mediterranean. In 1936 it was reported from Alexandria, Egypt by Balss (1936, pp. 38-39), who dealt with rather extensive material from a depth of 4 to 18 m.

***Pilumnopus vauquelini* (Audouin, 1826)**

Pilumnopus vauquelini Holthuis, 1956, p. 320.

Five specimens, two females (cl. 6 and 7 mm, the latter ovigerous) and three males (cl. 6.5 to 8 mm), were taken in Haifa harbour (7.VI. 1951, 6.VII.1952 and 1. XII.1954). The ovigerous female was collected in December. The specimens agree very well with the published descriptions of the species. The pleopod of the male checks perfectly with Stephensen's (1945, figure 35) figure of that organ of specimens from the Persian Gulf.

Pilumnopus vauquelini inhabits the Red Sea and the Persian Gulf and has migrated through the Suez Canal to the E Mediterranean. It is probably the first crab ever to be recorded from the Suez Canal, since Keller's (1883) "kleine Krabbe" was identified by Krukenberg (1888) with the present species. Further records of the species from the Suez Canal are by Krukenberg (1888), Calman (1927), Fox (1927), Monod (1937, 1938) and Holthuis (1956). The records from the E Mediterranean are: Port Said (Calman 1927, Fox 1927), near Alexandria (Balss 1936). The species was reported from Israel by Holthuis (1956).

***Pilumnus hirtellus* (Linnaeus, 1758)**

Pilumnus hirtellus Gottlieb 1953, p. 440.

A juvenile female (cl. 4 mm) which evidently belongs to the typical *Pilumnus hirtellus* (L.) was collected in a rock pool near Caesarea (date unknown). The specimen has the frontal margin without spines. The teeth of the lower orbital border are small and of about equal size. There are five antero-lateral teeth (the orbital tooth included), the second of which is quite small. The palm of the larger cheliped has the outer surface smooth and naked for the larger part, the smooth area extending also over the upper half of the palm. The carpi of the walking legs do not show antero-dorsal spines. The carapace, especially in its posterior part, is far less hairy than in *Pilumnus spinifer* H. Milne Edwards.

Pilumnus hirtellus is known from the entire Mediterranean, the Black Sea and from the E Atlantic between the North Sea and the Cape Verde Islands. It has been recorded from the following E Mediterranean localities: near Istanbul, near

San Stefano, near Aphisia Island, and near Gallipoli, Sea of Marmara (Ostroumoff 1896), Crete (Lucas 1853, Raulin 1870), Sporades, 37° 37'N 26° 58'E (Adensamer 1898), Rhodes (Santucci 1928), Bay of Alexandretta (=Iskenderon), Turkey (Monod 1931), Caesarea, Israel (Gottlieb 1953), near Alexandria, Egypt (Balss 1936). Since the systematics of the E Atlantic representatives of the genus *Pilumnus* are rather confused, it is not certain that the just cited records indeed pertain to the typical *Pilumnus hirtellus*.

***Pilumnus spinifer* H. Milne Edwards, 1834**

The species was collected in the following Israel localities : off Nahariya (samples 506, 1001), Haifa Bay (samples 98, 149, 169, 180, 226, 241, 245, 257, 258, 291, 316, 318, 346, 348, 398), off Natanya (trawl, 11.XII.1946), off Nabi Rubin (sample 832). The material was obtained at depths between 18 and 59 m; it consists of twenty-one specimens (cl. 4 to 15 mm), one of which is ovigerous (cl. 9 mm). The ovigerous female was collected in February (sample 348).

These specimens have the margin of the front with a deep median incision which at each side bears a strong acute tooth, externally of which some smaller teeth are placed; these are followed by a concave and unarmed part of the margin, while the antero-lateral angle of the margin ends in a spine. In smaller specimens the frontal teeth are generally less distinct than in the adults, but in some of the latter they seem to be worn down. The upper orbital border shows two fissures but no teeth. On the lower border of the orbit there are several rather widely and irregularly spaced teeth of various size, some of which are very strong. There are generally five antero-lateral teeth (the orbital tooth included), though the second may be very small and inconspicuous (like in the specimens of samples 241 and 506); in one specimen (sample 241) also the fifth antero-lateral tooth is conspicuously smaller than the fourth and the third. The carpus of the chelipeds bears numerous strong spines. The palm of the larger cheliped has the lower part of the outer surface smooth and naked, while hairs and spines are visible in the upper part. The smaller chela has the outer surface of the palm covered with tubercles all over. The carpus of the ambulatory legs bears a very strong distal spine on the upper margin (in the specimen of sample 348, these spines are very indistinct in the second legs). The carapace bears long and short stiff hairs and in addition to these some tufts of plumose hairs which give the animal a somewhat shaggy appearance.

Pilumnus spinifer H. Milne Edwards probably is a good species, specifically different from *Pilumnus hirtellus* (L.). The problem whether or not *Cancer villosissimus* Rafinesque, 1814, and *Pilumnus villosus* Risso 1827, are distinct or identical with *Pilumnus spinifer*, requires investigation.

The present form has been reported from the entire Mediterranean, the Black Sea, the Portuguese coast, the Azores, and Mauritania. The previous records of this

species from the E Mediterranean are : Crete (Lucas 1853, Raulin, 1870). In the collection of the Sea Fisheries Research Station, Haifa, a male (cl. 17 mm) of this species from Mersin Bay, Turkey, is present.

***Eriphia verrucosa* (Forskal, 1775) (Plate III, figure 13)**

Eriphia spinifrons Steinitz, 1933, p. 152; Bodenheimer, 1937, p. 281; Gottlieb, 1953, p. 440; Carmin, 1955, p. 2.

Twenty-four specimens (cl. 3 to 60 mm) were examined from : Haifa Bay (a detached chela in sample 169, dredge, depth 31 m, 30.XI.1954; near the mouth of Kishon river, 4.VIII.1955), Caesarea (in rock pools, 3.IV.1951, 12 and 19.VI. and 16.VII.1952, and VI.1954), Tel Aviv (8.VI.1929, 3.I.1930, 31.XII.1931, 2.VIII.1935, 25.VI.1939, leg J. Carmin), Bat Yam (19.VI.1929, leg. J. Carmin; 1.XI.1945, coll. Institute of Natural Sciences, Oranim), Mediterranean coast of Israel (leg. J. Carmin). An ovigerous female was collected in April. This species is very common in the littoral area of the Israel coast, from where it was reported for the first time by Steinitz (1933), who dealt with material from Haifa. Gottlieb's (1953) material was collected in Caesarea rock pools, while Carmin's (1955) record is based on the above mentioned specimens of the Carmin collection.

Forskal's (1775, p. 93) description of his *Cancer verrucosus* runs as follows : "*Cancer verrucosus*; brachyurus; thorace laevi, utrinque 6-dentato; fronte multi-dentata; manibus verrucosis, apice nigris. Descr. Os latum. Chela dextra glabra & saepe major. Manuum apices nigri. Carpi quoque verrucosi. In reliquis pedibus carina femorum superior & tibiae ac tali pilis hispidi. Ad Thoracis latera utrinque 6. dentes validi post oculos. Inter oculos antice dentes minores plurimi, serie varia." Though this description, which is based on specimens from Constantinople (= Istanbul), is rather short, it does not leave the least doubt as to the identity of *Cancer verrucosus* Forskal, 1775, with *Cancer spinifrons* Herbst, 1785. The former name is the older of the two and has to be used for the present species, which usually is indicated with the incorrect name *Eriphia spinifrons*.

Eriphia verrucosa inhabits the entire Mediterranean and is furthermore known from the Black Sea and the E Atlantic between the S coast of Brittany, France, in the north and the Azores and Mauritania in the south. The records from the E Mediterranean are : Navarino Bay, Methone (= Modon), and Sapienza, S Greece (Guérin 1832), Istanbul (Forskal 1775, Ninni 1923), Sea of Marmara (Pesta 1918), Khania, NW Crete (Lucas 1853, Raulin 1870), Rhodes (Parisi 1913, Colosi 1923, Tortonese 1947), Israel (Bodenheimer 1937, Carmin 1955), Haifa (Steinitz 1933), Caesarea (Gottlieb 1935), Egypt (Audouin 1826), near Alexandria, Egypt (Balss 1936), Derna, Tolmeta, and Benghazi, Cyrenaica (Colosi 1923). Monod (1937, 1938) reported the species from the Suez Canal. The Rijksmuseum van Natuurlijke Historie possesses material of this species from Benghazi, Cyrenaica (rocky and sandy beach, XI.1951, C. Beets). Seventeen specimens of this

species (one of which infested with a Rhizocephalan) from Istanbul (XI., X.1923, H. C. Kellers) were examined in the U.S. National Museum, Washington, D. C.

Family GONEPLACIDAE

Goneplax rhomboides (Linnaeus, 1758)

Goneplax angulata Gottlieb, 1953, p. 440.

Material has been examined from: Haifa Bay (samples 163, 254, 265, 268, 286, 334), off Caesarea (trawl, depth 219m, 17.V.1953), off Natanya (samples 703, 1008), off Herzliya (samples 568, 569a), off Tel Aviv (sample 622), off Ashkelon (sample 580). The material was obtained from depths between 42 and 219 m; it consists of fourteen specimens which have carapace lengths ranging from 4 to 15 mm; no ovigerous females are present. The two specimens from off Natanya are both parasitized by Sacculinid Rhizocephala; the specimen of sample 703 has two, the other one parasite under the abdomen.

The name *Cancer rhomboides* Linnaeus, 1758, is older than *Cancer angulatus* Pennant, 1777, and therefore the former specific name must be used for the species by those authors who synonymize the two. Some specialists consider the two forms as distinct species or subspecies, *C. angulata* differing from *C. rhomboides* by possessing an additional tooth behind the antero-lateral tooth of the carapace. Other carcinologists (as Bouvier, 1940) report numerous transitions between the two forms which they therefore consider as a single species. Regardless of the actual taxonomic status of the two forms, the specific name *rhomboides* has to be used for the present Israel specimens, since all of them show only one antero-lateral tooth.

Goneplax rhomboides is known from the entire Mediterranean, from the Canary Islands and from Mauritania. If *Cancer angulata* is a synonym, the range of the species extends in the E Atlantic from the English S coast to S Africa. Records of *G. rhomboides* from the E Mediterranean are: coast of Argolis Province and of Methana Peninsula, Peloponnesos; Cyclades, Greece (Guérin 1832), NW of Crete, 35° 48'N 23° 34'E (Steindachner 1891, Adensamer 1898), near Khania, NW Crete (Lucas 1853, Raulin 1870), Sporades, 37° 37'N 26° 58'E (Adensamer 1898), Israel (Gottlieb 1953). Monod (1931) reported *Goneplax angulata* from the Gulf of Alexandretta (= Iskenderon), Turkey, while Balss (1936) mentioned that species from Alexandria, Egypt; it is not certain to which of the two forms these specimens belong.

Family OCYPODIDAE

Ocypode cursor (Linnaeus, 1758) (Plate III, figure 14)

Ocypoda cordimana Steinitz 1929, p. 79; Steinitz 1933, p. 153; Bodenheimer 1935, p. 468, plate 68, figure 9 (*O. longimana* on plate); Bodenheimer 1937, p. 281 (Not *Ocypode cordimana* Desmarest, 1825).

Ocypoda hippeus Aharoni 1944, p. 41.

Ocypoda cursor Gottlieb 1953, p. 440.

Ocypode cursor Carmin 1955, p. 2.

Material has been examined from : Caesarea (beach), Tel Aviv (11. and 25.VI.1929, leg. J. Carmin), Jaffa (sandy beach, 1921, leg. P. A. Buxton, coll. British Museum), Bat Yam (28.V.1929, leg. J. Carmin), Nabi Rubin (1920, leg. I. Aharoni, coll. British Museum). Thirteen specimens were examined, their carapace length varying from 24 to 35 mm. The species is quite common all along the Israel coast. Steinitz' (1929, 1933) specimens, originating from near Haifa, were identified by that author with the Indo-West Pacific species *Ocypode cordimana* Desmarest; since all our *Ocypode* material belongs to *O. cursor*, a species which proves to be very common on the Israel sandy beaches and which has not been mentioned by Steinitz, it seems extremely probable that Steinitz' record is based on the present form. Carmin's (1955) record of the present species is largely based on the above Tel Aviv and Bat Yam material.

Ocypode cursor (also named *O. ippeus* or *O. hippeus*) inhabits the sandy shores of the E Mediterranean and those of the N and W coasts of Africa south to Angola. The records from the E Mediterranean are : beaches of Astros and Nisea near Megara, S Greece (Guérin 1832), Syria (Hasselquist 1757, Lamarck 1818), between Sidon and Tyre, Lebanon (Olivier 1802), Israel (Bodenheimer 1935, 1937, Aharoni 1944, Gottlieb 1953, Carmin 1955), Haifa, Israel (Steinitz 1929, 1933), Egypt (Hasselquist 1757, Lamarck 1818, Audouin 1826), near Alexandria, Egypt (Balss 1936). Specimens from Burlos Beach, Gharbies Province, Egypt (15.VI.1916, leg. M. J. Nicoll) were examined in the British Museum (Natural History). Since ancient times this species is known from the E Mediterranean as is shown by Aristotle's remarks dealing with this species : "In the neighbourhood of Phoenice there are found on the beach certain crabs that are nicknamed the "horsemen" from their running with such speed that it is difficult to overtake them; these crabs, when opened, are usually found empty, and this emptiness may be put down to insufficiency of nutriment" (see Thompson, 1910, S 525 b, lines 7 to 10). The ancient Phoenicia occupied the narrow coastal strip of the N. part of present-day Israel (N of Mt. Carmel), the Lebanon and Syria, so that Aristotle's observations even may have been based on Israel specimens. The material collected on the coast of Syria by M. Labillardière, which Audouin (1826, p. 255) identified as *Ocypode rhombea*, in all probability belongs to *O. cursor*.

Family GRAPSIDAE

Pachygrapsus marmoratus (Fabricius, 1787) (Plate III, figure 15)

Pachygrapsus marmoratus Steinitz, 1933, p. 152; Bodenheimer, 1935, p. 468; Bodenheimer, 1937, p. 281; Gottlieb, 1953, p. 440; Carmin 1955, p. 2.

Material was examined from : Caesarea (rock pools, 3.IV.1951, 16.V. and 10.VI.1954, and 26.V.1955), Mediterranean coast of Israel (leg. J. Carmin). The spec-

imens have carapace lengths ranging from 11 to 30 mm. The species is very common in the Caesarea area from where it has already been reported by Gottlieb (1953). Steinitz (1933) mentioned it from Haifa. Carmin's (1955) record is based on the above material. According to Carmin the species appears in May or June in large numbers on the coast and can be found until December; Steinitz (1933) stated that it appears already in March. Carmin's remark that the species is often covered by seaweed probably is based on a mistake, since this species, like most Grapsids, have their body usually remarkably free from any growth.

Pachygrapsus marmoratus is known from the entire Mediterranean, the Black Sea, and the E. Atlantic between the Normandy coast of France in the north, and Morocco, the Canary Islands, the Azores and Madeira in the south. The records from the E Mediterranean are : Pylos, Sapienza and Marathonesi, S Greece (Guérin 1832, as *Grapsus varius*), Phaleron Bay near Athens, Greece (Athanasopoulos 1917, as *Grapsus varius*), Istanbul (Stimpson 1861), Gallipoli, Sea of Marmara (Ostroumoff 1896), Khania, NW Crete (Lucas 1853, Raulin 1870, both as *Grapsus varius*), Khos (=Coo), Sporades (Santucci 1928), Rhodes (Santucci 1928, Tortonese 1947), Cyprus (Heller 1863, Unger and Kotschy, 1865, as *Grapsus varius*), Israel (Bodenheimer 1935, 1937, Carmin 1955), Haifa (Steinitz 1933), Caesarea, Israel (Gottlieb 1953), Egypt (Audouin 1826, as *Grapsus varius*), Alexandria, Egypt (Balss 1936), Derna, Apollonia, Tolmeta and Benghazi, Cyrenaica (Colosi 1923). In the U.S. National Museum, Washington, D.C., E Mediterranean material of this species has been examined from Istanbul (IX.,X.1923, H.C. Kellers), and 1 mile off Mersa Matruh, Egypt (on rocks, 8.X.1950, R.E. Kuntz).

***Pachygrapsus transversus* (Gibbes, 1850)**

Pachygrapsus maurus Steinitz 1933, p. 152; Bodenheimer 1935, p. 468; Bodenheimer 1937, p. 281; Gottlieb 1953, p. 440.

Pachygrapsus transversus Carmin, 1955, p. 2.

The material examined originates from : Atlit (13.VI.1929, leg. J. Carmin), Caesarea (rock pools, 3.IV.1951, 19.III. and 10.VI.1952, 20.VI.1953, 26. V., 10 and 23.VI. 1954), Tel Aviv (11 and 21.V. and 29.VI. 1929, 3.I. 1930, 31.XII. 1931 and 5.VI.1932, leg. J. Carmin), Bat Yam (19.VI.1929, leg. J. Carmin), Mediterranean coast of Israel (leg. J. Carmin). On the Israel coast the species is far commoner than *Pachygrapsus marmoratus*. Twenty-eight specimens were examined (cl. 4 to 17 mm); an ovigerous female was found in June.

Steinitz, Bodenheimer and Gottlieb reported on this species under the name *P. maurus*, which, though it is a closely related species, is completely distinct. Steinitz' material came from Haifa, that of Gottlieb from Caesarea. Carmin's (1955) record of the species is mainly based on his above mentioned material.

Pachygrapsus transversus is an inhabitant of the E Atlantic (Mediterranean; Cape Blanco, Madeira and Canary Islands to Angola), W Atlantic (Massachusetts;

Bermuda and North Carolina to Uruguay), and E Pacific (California to Peru). The species is indicated generally as also inhabiting the Indo-West Pacific area (E. Australia, New Zealand, Tahiti). In Australia the species has been reported from the coast of New South Wales, from Sydney north to Ballina. Holthuis in 1955 collected material of this form near Collaroy (Long Reef) and Mosman, both localities being slightly N of Sydney, N.S.W. Examination of these animals proved that they belong to a species which is perfectly distinct from *Pachygrapsus transversus* and which should be known as *Pachygrapsus laevimanus* Stimpson. Both the New Zealand and the Tahiti records of *P. transversus* were published by Kingsley (1880, p. 200), but not confirmed by later authors; Kingsley evidently did not even examine the Tahiti material himself as he did not provide that record with an exclamation mark. Chilton and Bennett (1929, p. 762), when reviewing the New Zealand Brachyuran fauna, considered the record of *Pachygrapsus transversus* from New Zealand as doubtful. It is impossible, therefore, to consider at the moment *Pachygrapsus transversus* as a species inhabiting the Indo-West Pacific area.

In the W. Mediterranean the species has been found only once, namely in Marseilles harbour, where it was taken from the bottom of a ship coming from Pondicherry via the Cape of Good Hope. In the E Mediterranean the species is well established, as is shown by the Israel material. It has also been reported from Port Said, Egypt (Calman 1927) and Alexandria (Balss 1936). The collection of the U.S. National Museum, Washington, D.C., possesses material of this species from Port Said (VI.1922, H.C. Kellers). Uncertainty exists as to whether the E Mediterranean range of *Pachygrapsus transversus* is connected with the W African or that it found its origin in an accidental introduction of the species.

***Planes minutus* (Linnaeus, 1758)**

The collection of the Haifa Sea Fisheries Research Station contains a male (cl. 16 mm) which in all probability was taken at the Mediterranean coast of Israel, though definite locality data are lacking.

As shown by Chace (1951), *Planes minutus* is most abundant in the Atlantic Ocean between the equator and 50° N, though there are records from the S Atlantic, the Indian and the Pacific Oceans. In all probability, all of the Indo-Pacific material belongs to *Planes cyaneus* Dana. There are several records of *Planes minutus* from the Mediterranean, but only one from the eastern part: Cyprus (Heller 1863).

***Brachynotus sexdentatus* Risso, 1827) ssp.**

Brachynotus sexdentatus Carmin 1955, p. 2; Forest, 1957, p. 503.

Brachynotus sexdentatus gemmellaroi Monod 1956, p. 434.

Material has been examined from : Mediterranean coast of Israel (leg. J. Carmin), Shikmona near Haifa (20.XII. 1954), Caesarea (rock pools, 16.VII. and 5.VIII. 1952, 10.VI.1953 and V.1954, leg. E. Gottlieb), Tel Aviv (11.V. 1929,

leg. J. Carmin). Thirteen specimens (cl. 2.5 to 11 mm) were examined, none of these being ovigerous. Carmin's (1955) record of this species is mainly based on the above specimens of his collection, that by Monod on the above Tel Aviv material, while Forest (1957) mentioned material from Caesarea.

Dr. Ricardo Zariquiey Alvarez of Barcelona informed Holthuis that in his Spanish material of *Brachynotus sexdentatus* two forms can be recognized, one being the true *B. sexdentatus* (Risso). The other differs from the typical form in several characters: it is smaller, the front is more deeply emarginate in the middle, the orbits are deeper, the ocular peduncle is broader and not pointed at the apex, the carapace shows some distinct ridges, which are not or only vaguely visible in the typical form, the propodus of the fifth leg is shorter and the dactylus of that leg is more strongly curved; furthermore, the last joint of the male abdomen is more quadrangular, being more or less triangular in the typical form, and the merus of the third maxilliped has the inner proximal and the outer distal corner about straight, being more rounded in the typical form. A direct comparison of our larger Israel specimens (those from Tel Aviv) with material of both Spanish forms showed it to belong to the atypical form, which it resembles in all respects. Our other Israel specimens evidently also belong to this second form but some are too small (cl. 2.5 to 4 mm) to decide this with certainty. It is hoped that Zariquiey's study on *Brachynotus* will soon be published.

Brachynotus sexdentatus (Risso) s. l. inhabits the entire Mediterranean and the Black Sea while it has penetrated into the Suez Canal as far as Lake Timsah; quite recently the species has been found in Swansea (Great Britain), where it evidently has been accidentally introduced (cf. Naylor, 1957). The specimens reported from the Atlantic coast of Morocco and Mauritania prove to belong to a distinct species, *B. atlanticus* Forest (cf. Forest, 1957). The records from the E Mediterranean are: near Khania, NW Crete (Lucas 1853, H. Milne Edwards 1853, Raulin 1870), Cyprus (Heller 1863), Israel (Carmin 1955), Port Said, Egypt (Calman 1927, Fox 1927), Lake Menzaleh near Port Said (Calman 1927), Lake Timsah, Suez Canal (Calman 1927, Fox 1927; ? Tortonese 1952), near Alexandria, Egypt (Balss 1936). As to the distribution of the two forms, the typical form is known with certainty from Spain (Barcelona), S. France (Nice), Italy (Naples), Algeria (Algiers and Bône), and Great Britain (Swansea). Apart from Israel, the atypical form is only known with certainty from S. France (Racou, N. of Collioure), and from two localities in the province of Barcelona, NE Spain (Sitges to the south, and Arenys to the north of Barcelona).

Family PINNOTHERIDAE

***Pinnotheres pisum* (Linnaeus, 1767)**

Six females (cl. 6 to 9 mm) were examined. Two of these originate from Acre (on beach, commensal in *Mactra corallina* (L.), 2.II.1955; on beach with shells of *Meleagrina albina* (Lam.), 12.XII.1955). The other four were collected in Haifa

Bay (II.1956), where they were found in *Macra*. Two of the Haifa Bay specimens (cl. 8 and 9 mm) are ovigerous. Furthermore, a male (cl. 5 mm) from the Mediterranean coast of Israel (exact locality not known) is present in the collection studied. The specimens agree well with Bouvier's (1940) account of this species.

Pinnotheres pisum inhabits the entire Mediterranean and the E Atlantic from Norway to Mauritania. The previous records of the species from the E Mediterranean are: Phaleron Bay near Athens, Greece (Athanassopoulos 1917), near Princes Islands (= Kizil Adalar), E Sea of Marmara (Ostroumoff 1896). Since Athanassopoulos found part of his specimens in *Pinna*, it is very well possible that his material partly or entirely belongs to *Pinnotheres pinnotheres* (L.).

Family PALICIDAE

Palicus caronii (P. Roux, 1830)

One specimen (cl. 6 mm) was collected in Haifa Bay (sample 107, depth 70 m), and one (cl. 10 mm) off Kfar Vitkin (sample 520, depth 90 m).

The name *Cymopolia caronii* has often been used for this species, but the generic name *Cymopolia* Roux, 1830 (Crust. Medit., p. 77) is preoccupied by *Cymopolia* Lamouroux, 1816 (Hist polyp. corall. flex., p. 292), as has already been pointed out by Rathbun (1897, p. 93), who correctly substituted *Palicus* Philippi (1838) for Roux' *Cymopolia*. The fact that Lamouroux' genus *Cymopolia* is an alga and not a polyp as Lamoroux thought, does not make *Cymopolia* Roux an available name. Article 1 of the International Rules of Zoological Nomenclature states that "if an organism is transferred from the animal to the vegetable kingdom its names retain their zoological status". *Cymopolia* Roux, 1830, therefore is invalid and has to be replaced by *Palicus* Philippi, 1838. It is to be regretted that Rathbun (1915, p. 180) returned to the use of *Cymopolia* Roux on the assumption that it could not be invalidated by the botanical *Cymopolia* Lamouroux.

Until now *Palicus caronii* was known only from the W Mediterranean, and from W Africa down to the Gulf of Guinea.

Family PARTHENOPIDAE

Lambrus angulifrons (Latreille, 1825)

Three specimens (cl. 8 to 12 mm) were collected in Haifa Bay (sample 215, depth 30 m), and off Rafah (sample 544, depth 23 m).

The species inhabits the entire Mediterranean. The only previous record from the E Mediterranean is by Monod (1931), who reported it from the Gulf of Alexandretta (= Iskenderon), Turkey.

Lambrus macrochelos (Herbst, 1790)

Seven specimens (cl. 16 to 32 mm) from the following localities were examined: Haifa Bay (samples 233, 236, 277, 281; depths between 18 and 97 m), off Nabi Yunis (trawled, depth 146 m, 5.V.1953).

The species inhabits the entire Mediterranean and, furthermore, is known from the E Atlantic between Portugal and Angola. Records from the E Mediterranean are: Methana peninsula, Gulf of Aigina, S Greece (Guérin 1832, as *Lambrus mediterraneus*), Phaleron Bay near Athens, Greece (Athanasopoulos 1917, as *Lambrus mediterraneus*).

***Lambrus massena* Roux, 1830**

Lambrus massena Gottlieb, 1953, p. 440.

Ten specimens (cl. 7 to 14 mm) were collected off Nahariya (sample 552), and in Haifa Bay (samples 79, 92, 191, 239, 241, 289, 297), at depths between 35 and 79 m. The only ovigerous female (cl. 10 mm) was collected in June (sample 239).

The species is known from the entire Mediterranean and from the E Atlantic between the Brittany coast of France and the Congo. E Mediterranean records are: near Kalolimno (=Imralü) Island, Sea of Marmara (Ostroumoff 1896), Israel (Gottlieb 1953).

Family MAJIDAE

***Maja squinado* (Herbst, 1788)**

Maja squinado Gottlieb 1953, p. 440.

Two specimens (cl. about 80 mm) trawled in V.1953 off Nabi Rubin at a depth of 146 m (coll. Institute of Natural Sciences, Oranim). It is on these specimens that Gottlieb's (1953) record is based.

Maja squinado is known from the entire Mediterranean and from the E Atlantic between the British Isles and French Guinea. Records from the E Mediterranean are: Syros, Cyclades (Guérin 1832), Athens market (Athanasopoulos 1917), Bosphorus (Ninni 1923), Crete (Lucas 1853, Raulin 1870), Rhodes (Tortonese 1947, 1947a), Syria (Gruvel 1928, 1931, Monod 1931), Israel (Gottlieb 1953), Egypt (Gruvel 1928), Tolmeta, Cyrenaica (Colosi 1923). The U. S. National Museum, Washington, D. C., possesses E Mediterranean material of this species from Greece (old collection) and Istanbul (IX.—X.1923, H. C. Kellers).

***Maja verrucosa* H. Milne Edwards, 1834**

A male (cl. 38 mm) was collected on 14.1.1954 at the Haifa coast (coll. Institute of Natural Sciences, Oranim). A female (cl. 37 mm) from the Mediterranean coast of Israel is in the collection of the Tel Aviv Institute of Natural Science.

Maja verrucosa inhabits the entire Mediterranean and the E Atlantic from Portugal to Mauritania and the Cape Verde Islands. Records from the E Mediterranean are: Syros and Naxos, Cyclades (Guérin 1832), Phaleron Bay near Athens, Greece (Athanasopoulos 1917), Bosphorus (Ninni 1923), S end of the Bosphorus, near Princes Islands (=Kizil Adalar), and near San Stefano, E Sea of Marmara (Ostrou-

moff 1896), Khos (=Coo), Sporades (Santucci 1928), Rhodes (Parisi 1913, Tortonese 1947), Crete (Lucas 1853, Raulin 1870), Egypt (Audouin 1826).

***Maja goitziana* Oliveira, 1888 (Plate III, figure 16)**

A male (cl. 40 mm) was collected on the Mediterranean coast of Israel by L. Fishelson and C. Levinson, it is preserved dry and was donated by the Institute of Natural Science at Tel Aviv to the Rijksmuseum van Natuurlijke Historie, Leiden.

By the presence of a very strong antero-dorsal spine on the meri of the walking legs, the species may immediately be distinguished from *Maja squinado* and *M. verrucosa*. Also, the arrangement of the spines on the carapace differs distinctly from that of the two other species. The five spines of the median line of the carapace, are far longer and slenderer than in *M. squinado* and *M. verrucosa* where they are low and look more like sharply topped tubercles. In *M. goitziana* there are two slender spines placed between the median line of the carapace and the last of the antero-lateral spines; in the two other species only one spine is present there. The legs of the species are more slender than in *M. squinado*, rather resembling those of *M. verrucosa*.

M. goitziana is closely related to *M. spinigera* De Haan, a species until now only known from Japan. A comparison of our Israel specimen of *M. goitziana* with the types of *M. spinigera* showed the following differences. The distance between the third and fourth median spine of the carapace (counted from the rostrum backwards) in *M. goitziana* is smaller than the distance between the second and the third, in *M. spinigera* the second and the third spine are placed far closer together than the third and fourth. As already remarked above, in *M. goitziana* two slender spines are placed on the carapace between the last antero-lateral tooth and the median line of spines, in *M. spinigera*, however, three such spines are found there. Of the two teeth in which ends the basal antennal segment, in *M. goitziana* the outer is slightly longer than the inner, while in *M. spinigera* the inner is distinctly longer than the outer. The postero-external lobe at the base of the basal antennal segment, which forms part of the orbit, is strongly pointed in *M. spinigera* and in *M. squinado*, it is truncated in *M. verrucosa* and rounded in *M. goitziana*.

M. goitziana is now, for the first time, reported from the Mediterranean. It was known only from specimens collected at different localities off the Portuguese coast and off the W African coast (from French Guinea to French Congo).

***Pisa muscosa* (Linnaeus, 1758)**

Pisa ?armata Gottlieb, 1953, p. 440.

Three specimens of this species (cl. 7-25 mm) have been examined by us. They originate from the following localities: Haifa Bay (samples 224 and 298), Mediterranean coast of Israel (further data unknown). They were dredged at depths between 27 and 33 m.

There has been much difference of opinion about the status of the *Pisa* species belonging to the *tetraodon* group. Pesta (1918, p. 338) considered *Pisa tetraodon* (Pennant, 1777) as one large variable species, which he did not subdivide. Bouvier (1940, p. 330) recognised two forms in this species: forma *tetraodon* (Pennant, 1777) and forma *corallina* (Risso, 1816), the former being the broad, the latter the slender form. Zariquiey (1956, p. 406) elevated the slender form to the rank of a full species. A study of an extensive material convinced us of the correctness of Zariquiey's ideas and we even think it necessary to distinguish a third species in this group. As to the nomenclature, the name *Pisa tetraodon* (Pennant, 1777) may be kept for the broad form, the slender form should be named *Pisa muscosa* (Linnaeus, 1758), while the name *Pisa corallina* (Risso, 1816) is the correct name for the third species, which is more or less intermediate between the other two. A more elaborate discussion of the problem will be published in the near future by Zariquiey and Forest.

All the Israel specimens examined by us prove to belong to the slender form and thus have to bear the name given above.

Due to the confusion regarding the systematic status of this and the two related species, the records given in the literature cannot be relied upon. Under the name *Pisa tetraodon* specimens have been reported from: near Tekirdagh (=Rodosto), and near the S coast of Marmara Island, Sea of Marmara (Ostroumoff, 1896), Khos (=Coo), Sporades (Santucci, 1928), near Khania, N.W. Crete (Lucas, 1853; Raulin, 1870), St Georges Bay, Beirut, Lebanon (Monod, 1931), near Alexandria, Egypt (Balss, 1936); under the name *Pisa intermedia* Nardo from: Tekirdagh (=Rodosto), Sea of Marmara (Ostroumoff, 1896); and under the name *Pisa corallina* from: Phaleron Bay near Athens, Greece (Athanasopoulos, 1917), S end of Bosphorus, and E coast of Aphisia Island, Sea of Marmara (Ostroumoff, 1896). *Pisa intermedia* Nardo, 1869, is synonymous with *P. corallina* (Risso). The latter name, however, has been used by several authors for the slender form indicated here as *P. muscosa* and not for the true *P. corallina*. The present species was first recorded from Israel by Gottlieb (1953), whose specimen, a juvenile (cl. 7 mm) of which no other data are known than that it was collected on the Mediterranean coast of Israel, was referred by him with some doubt to *P. armata*.

***Pisa nodipes* Leach, 1815**

Pisa nodipes Gottlieb, 1953, p. 440.

Four specimens have been examined by us: two (cl. 28 and 31 mm) were collected at the Mediterranean coast of Israel (other data unknown), a male (cl. 22 mm) was caught with a bottom sampler off Nahariya (sample 1034, depth 18 m), and a male (cl. 27 mm) was taken with a trawl in Haifa Bay (9.IV.1946).

The species is found in the entire Mediterranean and in the E Atlantic between Portugal and the Cape Verde Islands. The only records from the E Mediterranean known to us are: Israel (Gottlieb 1953), near Alexandria, Egypt (Balss 1936).

Eurynome aspera (Pennant, 1777)

Eight specimens (cl. 3 to 16 mm) were collected: Haifa Bay (samples 107, 191, 233, 263, 338), off Kfar Vitkin (sample 618); they were obtained at depths between 49 and 93 m.

The species is known from the entire Mediterranean and from the E Atlantic between W Norway and the Gulf of Guinea. E Mediterranean records are: S end of the Bosphorus, near Princes Islands (= Kizil Adalar), and near Marmara Island, Sea of Marmara (Ostroumoff 1896), near Alexandria, Egypt (Balss 1936).

Acanthonyx lunulatus (Risso, 1816)

Acanthonyx lunulatus Steinitz 1933, p. 149; Bodenheimer 1937, p. 281; Gottlieb 1953, p. 440.

Acanathonyx lunulatus Carmin 1955, p. 2.

Extensive material of this species (79 specimens, cl. 4 to 16 mm) has been examined; it was collected at: Caesarea (rock pools, on weeds, 3.IV.1951, 23.I., 6.III., 10.VI., 16.VII., 4. and 5.VIII.1952, and 26.V.1954), Tel Aviv (7.VIII.1929, 3.I., 12.III., 9 and 26.V., and 2.IX. 1930, leg. J. Carmin), Bat Yam (19.IV.1929, leg. J. Carmin). Ovigerous females were collected in April and August. Carmin's (1955) record is based mainly on the above Tel Aviv and Bat Yam material.

The species is known from the entire Mediterranean and from the E Atlantic between Portugal and Cameroons. E. Mediterranean records are: Pylos and Sapienza, S Greece (Guérin 1832), Soudha Bay, NW Crete (Lucas 1853, Raulin 1870), Rhodes (Santucci 1928, Tortonese 1947), Israel (Bodenheimer 1937, Gottlieb 1953, Carmin 1955), Haifa (Steinitz 1933), Caesarea, Israel (Gottlieb 1953), near Alexandria, Egypt (Balss 1936). The Museum of the Academy of Natural Sciences at Philadelphia, U.S.A., possesses 7 dry specimens from Greece (Expedition Morée, 1830, Guérin coll. no. 37, T. B. Wilson), which evidently form all or part of the material reported upon by Guérin (1832).

Inachus dorsettensis (Pennant, 1777)

Inachus dorsettensis Gottlieb, 1953, p. 440.

Seventeen specimens of this species (cl. 4 to 16 mm) were collected at the following localities: Haifa Bay (April 9, 1946; samples 110, 191, 200, 233, 241, 276, 279, and 373), off Nabi Yunis (depth 146 m, May 5, 1933). The Haifa Bay material was taken at depths between 49 and 88 m. Seven ovigerous females are present (cl. 7 to 10 mm), they were collected in the months April, June, and August (samples 110, 191, 276).

Apart from the above material which belongs to the typical *Inachus dorsettensis*, the present collection contains six specimens (cl. 6 to 13 mm) of a broad form, which sometimes has been indicated with the name *Inachus dorsettensis mauritanicus* Lucas. These specimens were all collected in Haifa Bay (samples 91, 108,

209, and 279); they were taken at depths ranging between 26 and 57 m. Two of them are ovigerous (cl. 11 and 13 mm), being collected in the months April and May (samples 91 and 209).

The species is known from the entire Mediterranean and from the E Atlantic between Norway and S. Africa. E Mediterranean records are: Cape Tainaron, S Greece (Guérin 1832, as *I. scorpio*), NW of Crete, 36° 3'N 23° 6'E (Adensamer 1898), Tenos, Cyclades (Guérin 1832, as *I. scorpio*), near S end of Bosphorus, Sea of Marmara (Ostroumoff 1896, as *I. scorpio*), Gulf of Alexandretta (= Iskenderon), Turkey (Monod 1931), Israel (Gottlieb 1953), near Alexandria, Egypt (Balss 1936).

Macropodia rostrata (Linnaeus, 1761)

Twenty-one specimens (cl. 6 to 16 mm) have been examined from: Mediterranean coast of Israel (further data unknown), off Nahariya (sample 553), Haifa Bay (samples 108, 180, 223, 241, 330, 352, 353, 388), off Atlit (sample 509). They were collected at depths between 27 and 55 m. The six ovigerous females (cl. 6 to 13 mm) of this collection were taken in January, June and July (samples 353, 509, 553). Two specimens of sample 509 carried a Rhizocephalan parasite under the abdomen.

Macropodia rostrata inhabits the entire Mediterranean, the Black Sea, and the E Atlantic between the Murman coast and S Africa. E Mediterranean records are: Methone (=Modon) Bay, and Marathonesi Island, Lakonia Bay, S Greece (Guérin 1832, as *Stenorhynchus phalangium*), near S end of the Bosphorus, and near Princes Islands (=Kizil Adalar), E Sea of Marmara (Ostroumoff 1896, as *Stenorhynchus phalangium*), Ras Beirut, Lebanon (Monod 1931) near Alexandria, Egypt (Balss 1936).

Macropodia longirostris (Fabricius, 1775)

Macropodia longirostris Steinitz, 1933, p. 148; Bodenheimer, 1935, p. 466; Bodenheimer, 1937, p. 281.

The insertion of this species in the list of Israel Decapoda is solely based on Steinitz' above record. All Israel representatives of this genus examined by us belong either to *M. rostrata* or to *M. longipes*. Steinitz' material probably was collected in Haifa Bay.

The species has been reported from the entire Mediterranean, the Black Sea and the E Atlantic between the Faeroes and Senegal. E Mediterranean records are: Phaleron Bay near Athens, Greece (Athanasopoulos, 1917), E part of Sea of Marmara, near Princes Islands (=Kizil Adalar), near Kalikratia, near Tekirdagh (=Rodosto), and near Aphisia Island, Sea of Marmara (Ostroumoff, 1896, as *Stenorhynchus longirostris* and *S. aegyptius*), Ras Beirut, Lebanon (Monod, 1931), Israel (Bodenheimer, 1935, 1937), Haifa, Israel (Steinitz, 1933), Egypt (Audouin, 1826, as *Stenorhynchus phalangium*; H. Milne Edwards, 1834, as *Steno-*

rynchus égyptius), near Alexandria, Egypt (Balss, 1936). A syntype of *Stenorynchus égyptius* H. Milne Edwards, 1834, is present in the collection of the Rijksmuseum van Natuurlijke Historie at Leiden. The specimen, which was collected in Egypt, proves to be a typical *Macropodia longirostris* (Fabr.).

Macropodia longipes (A. Milne Edwards and Bouvier, 1894)

Macropodia longirostris Gottlieb, 1953, p. 440.

Five specimens of this species (cl. 12 to 18 mm) were collected at the following localities: Haifa Bay (trawl, 9.IV.1946), off Nabi Yunis (depth 146 m, 5.V.1953).

Until now *Macropodia longipes* has only been reported from the French and Spanish coasts of the W Mediterranean; it was not yet known from the E Mediterranean.

IV. THE DISTRIBUTION OF THE DECAPOD CRUSTACEA
OF THE MEDITERRANEAN COAST OF ISRAEL

The Decapoda of the Mediterranean coast of Israel may be divided into two main components: the Atlantic element and the Indo-West Pacific. The Atlantic component is by far the larger of the two, consisting of 101 of the 117 species (36 Macrura, 20 Anomura and 45 Brachyura). Most of these species (33 Macrura, 18 Anomura and 40 Brachyura) inhabit the entire Mediterranean, generally penetrating into the E Atlantic and sometimes into the Black Sea. A second category, consisting of 2 Macrura, 2 Anomura and 4 Brachyura, is entirely or practically entirely absent in the European part of the Mediterranean, occurring in the E Atlantic, along the N African coast and along the coasts of Israel and Syria; a very good example is *Ocypode cursor*, which seems to be very common on the W and N coast of Africa, going eastwards as far as Egypt, Israel and Syria. Apart from an old record from Greece (Guérin 1832) this very conspicuous and characteristic species has not been mentioned at all from the European shores of the Mediterranean. The distribution of *Albunea carabus* is very similar (W Africa, Algeria, Israel, with an old record (Rafinesque 1814) from Sicily and one from Menorca). In this second category the species *Athanas amazone*, *Salmoneus jarli*, *Munida curvimana*, *Micropanope rufopunctata*, *Maja goltziana* and *Pachygrapsus transversus* have also to be placed, since they are known from the E Atlantic (various localities between Portugal and the Gulf of Guinea) and from Israel, in a few cases (*Micropanope* and *Pachygrapsus*) also being known from Egypt; some of these species (*Athanas*, *Salmoneus*, *Micropanope*) are small and may easily escape notice, so that it is possible that they may be found eventually in the N Mediterranean and thus actually belong to the first category. The new species *Automate branchialis* is also ranged under the Atlantic elements since it is far closer related to the Atlantic than to the Indo-West Pacific species of the genus; as so little is known about the distribution of this species, it cannot at the moment be placed in either of

the two above mentioned categories. Another Atlantic species which forms a category in itself is *Callinectes sapidus*, an American Brachyuran, which has unintentionally been introduced into Israel waters.

The Indo-West Pacific component of the Israel Mediterranean Decapod fauna consists of 16 species (9 Macrura, 7 Brachyura). All of these species obviously are recent immigrants which arrived in the Mediterranean by way of the Suez Canal.

V. APPENDIX

LIST OF THE SPECIES OF MARINE DECAPOD CRUSTACEA REPORTED FROM THE MEDITERRANEAN, EAST OF 20° E.

Suborder MACRURA

Family SERGESTIDAE

Sergestes arcticus Kröyer 1855

Under the name "*Sergestes arachnipedus* De Nat." Ostroumoff (1896 p. 67) reported a species from near Kalolimno (=Imralü) Island, Sea of Marmara. It is generally supposed that *Sergestes arachnipedus* (Cocco) De Natale is identical with *Sergestes arcticus*, but this is not entirely certain. Ostroumoff's record therefore is somewhat doubtful. According to Hansen (1922, p. 73) *S. arcticus* occurs in the Mediterranean to the west of 6°E.

Sergestes tenuiremis Kröyer 1855

Eastern basin of the Sea of Marmara (Ostroumoff 1896). Hansen (1922, p. 90 does not mention this species from the Mediterranean.

Sergestes robustus Smith 1882

South of Crete, 35° 8' N 24° 4'E (Adensamer 1898).

Sergestes corniculum Kröyer 1855 (See p. 13)

Sergestes vigilax Stimpson 1860

E Mediterranean, 32° 41' — 38° 11'N 19° 44' — 33° 35'E (König 1895, as *Sergia Clausi* König, and *Sergestes oculatus* Kröyer).

Lucifer typus H. Milne Edwards 1837 (See p. 14)

Lucifer hanseni Nobili 1905

Port Said, Egypt (Balss 1927, Gurney 1927, Fox 1927a), Suez Canal near Kabret (Balss 1927, Gurney 1927, Fox 1927a). According to Balss, the identification of this material is not certain.

Family PENAEIDAE

Solenocera membranaceum (Risso 1816) (See p. 14)

Gennadas elegans (Smith 1882)

Sea of Marmara, 40° 48'N 27° 59'E; Gulf of Korinthos, Greece, 38° 10'N 22° 33'E; Sporades, 37° 52'N 26° 22'E E of Rhodes, 35° 59'N 28° 14'E; N of Egypt, 32° 31'N 26° 51'E (Stephensen 1923).

Aristeus antennatus (Risso 1816) (see p. 14)

Aristaeomorpha foliacea (Risso 1827) (See p. 15)

Penaeus kerathurus (Forsk. 1775) (See p. 15)

Penaeus japonicus Bate 1888 (See p. 16)

Penaeus semisulcatus De Haan 1844 (See p. 16)

Parapenaeus longirostris (Lucas 1846) (See p. 18)

Metapenaeus stebbingi Nobili 1904

Syria and Egypt (Gruvel 1928), Port Said, Egypt (Balss 1927, Fox 1927a, Monod 1930, 1931, Gruvel 1931, 1936, Burkenroad 1934), Suez Canal (Krukenberg 1888, Balss 1927, Fox 1927a, Gurney 1927, Gruvel 1936, Monod 1937, Holthuis 1936), Bay of Abukir near Alexandria, Egypt (Balss 1936).

Metapenaeus monoceros (Fabricius 1798) (See p. 19)

Trachypenaeus curvirostris (Stimpson 1860) (See p. 20)

Sicyonia carinata (Brünnich 1768) (See p. 22)

Family OPLOPHORIDAE

Acanthephyra pelagica (Risso 1816)

Off Turkey, 35° 59'N 28° 14'E (Stephensen 1923, as *A. multispina*),

Acanthephyra eximia Smith 1884

W of Crete, 35° 26'N 23° 18'E; S of Crete, 34° 45'N 24° 23'E and 35° 4'N 24° 17'E; N of Egypt, 31° 39'N 28° 52'E; off Cyrenaica, 33° 11'N 22° 23'E and 33° 4'N 21° 16'E (Adensamer 1898, as *A. pulchra*).

Family NEMATOCARCINIDAE

Nematocarcinus ensifer (Smith 1882)

W. of Crete, 35° 26'N 23° 18'E; N of Crete 35° 59'N 25° 8'E; S of Crete, 34° 42'N 25° 14'E; off Cyrenaica, 33° 4'N 21° 16'E (Adensamer 1898).

Family PASIPHAEIDAE

Pasiphaea multidentata Esmark 1866

Off SW Turkey, 35° 59'N 28° 14'E (Stephensen 1923).

Pasiphaea sivado (Risso 1816)

Pasiphaea sivado Risso 1816

Gulf of Korinthos, Greece, 38° 10'N 22° 35'E (Stephensen 1923), Sapienza and Astros, S Greece; Naxos, Cyclades (Guérin 1832), Sea of Marmara, 40° 48'N 27° 54'E; Sporades, 37° 52'N 26° 22'E (Stephensen 1923).

Leptochela aculeocaudata Paulson 1875

Near Alexandria, Egypt (Balss 1936).

Leptochela pugnax De Man 1916 (See p. 22)

Family PALAEMONIDAE

Palaemon (*Palaemon*) *adspersus* Rathke 1837 (See p. 23)

Palaemon (*Palaemon*) *longirostris* H. Milne Edwards 1837 (See p. 23)

Palaemon (*Palaemon*) *xiphias* (Risso 1827) (See p. 24)

Palaemon (*Palaemon*) *serratus* (Pennant 1777) (See p. 24)

Palaemon (*Palaemon*) *elegans* Rathke 1837 (See p. 25)

Brachycarpus biunguiculatus (Lucas 1846) (See p. 26)

Palaemonella vestigialis Kemp 1922 (See p. 26)

Periclimenes (*Periclimenes*) *scriptus* (Risso 1822)

Cephalonia Island, W Greece (Heller 1863).

Periclimenes (*Harpilius*) *calmani* Tattersall 1921

Port Said, Egypt (Balls 1927, Fox 1927a, Gurney 1927a), also in the Suez Canal in Lake Timsah and at Kabret (Balss 1927, Gurney 1927, 1927a, Fox 1927a) and in the Great Bitter Lake (Holthuis 1956).

Pontonia pinnophyllax (Otto 1821)

Sapienza, S. Greece (Guérin 1832, as *P. custos*), Greece, (Sharp 1893, as *P. custos*)

Rhodes (Santucci 1928, as *P. custos*), Smyrna (= Izmir), W Turkey (Hasselquist 1757).

In the Museum of the Academy of Natural Sciences at Philadelphia, U.S.A. there are 7 specimens labelled Greece (Guérin coll. no. 338, T. B. Wilson); these evidently are Guérin's (1832) and Sharp's (1893) specimens.

Typton spongicola Costa 1844 (See p. 27)

Family ALPHEIDAE

Athanas nitescens (Leach 1814) (See p. 27)

Athanas amazone Holthuis 1951 (See p. 32)

Automate branchialis n.sp. (See p. 34)

Salmoneus ? *jarli* (Holthuis 1951) See p. 39)

Alpheus glaber (Olivier 1792) See p. 40)

Alpheus macrocheles (Hailstone 1835)

Sporades, 37° 37'N 26° 58'E (Adensamer 1898).

Alpheus dentipes Guérin 1832 (See p. 41)

Alpheus crassimanus Heller 1862

Alexandria, Egypt (Balss 1936), Suez Canal (Gruvel 1936, Monod 1937). Forest and Guinot (1956) mentioned the species from Sfax, Tunisia.

Aupheus audouini Coutière 1905 (See p. 41)

Alpheus inopinatus n.sp. (See p. 42)

Synalpheus gambarelloides (Nardo 1847) (See p. 48)

Family OGYRIDIDAE

Ogyrides mjobergi (Balss 1921) (See p. 48)

Family HIPPOLYTIDAE

Hippolyte inermis Leach 1815

Peloponnesos, Greece (Guérin 1832, as *Hippolytus brullei*; Sharp 1893, as *Virbius viridis*) Ras Beirut and St. George's Bay, Beirut, Lebanon (Monod 1931, as *H. prideauxiana*), near Alexandria, Egypt (Balss 1936, as *H. prideauxiana*).

A type specimen of *Hippolytus brullei* Guérin from Greece is preserved in the collection of the Philadelphia Academy of Natural Sciences; the specimen has also been mentioned by Sharp (1893).

Hippolyte longirostris (Czerniavsky 1869) (See p. 51)

Thoralus cranchii (Leach 1817) (See p. 51)

Family PROCESSIDAE

Processa canaliculata Leach 1815 (See p. 52)

Processa edulis (Risso 1816)

Near the islands of Marmara and Aphisia, and near Gallipoli, Sea of Marmara (Ostroumoff 1896), Naxos, Cyclades and several other, not specified localities in S Greece (Guérin 1832), Sporades, 36° 47'N 26° 29'E (Adensamer 1898), Mediterranean coast of Egypt (Kaiser 1889). All records are under the name *Nika edulis*; they may be based on any of the 8 European species of *Processa*.

Processa elegantula Nouvel and Holthuis 1957

The Station Marine d'Endoume at Marseilles recently donated to the Rijksmuseum van Natuurlijke Historie at Leiden a specimen of this species from off Lividia Point, Kalamata Gulf, Greece, 36° 46' 15" N 21° 59' 20" E, depth 63 m, IX.1955, Cruise of the "Calypso" Sta. 725.

Family PANDALIDAE

Plesionika edwardsii (Brandt 1851) (See p. 53)

Plesionika martia (A. Milne Edwards 1883)

E of the Peloponnesos, Greece, $36^{\circ} 58'N$ $24^{\circ} 18'E$ and $36^{\circ} 40'N$ $23^{\circ} 52'E$; NW of Crete, $35^{\circ} 59'N$ $22^{\circ} 56'E$, $35^{\circ} 48'N$ $23^{\circ} 34'E$ and $35^{\circ} 45'N$ $23^{\circ} 11'E$; N of Crete, $36^{\circ} 9'N$ $25^{\circ} 50'E$; Sporades, $36^{\circ} 47'N$ $26^{\circ} 29'E$, and $36^{\circ} 37'N$ $26^{\circ} 43'E$; N of Cyrenaica, $33^{\circ} 56'N$ $22^{\circ} 56'E$ (Adensamer 1898).

Plesionika acanthonotus (Smith 1882)

NW of Crete, $36^{\circ} 19'N$ $23^{\circ} 16'E$ (Adensamer 1898, as *Pandalus geniculatus*).

Plesionika heterocarpus (Costa 1871)

Off the S coast of Marmara Island, Sea of Marmara (Ostroumoff 1896), E of the Peloponnesos, $36^{\circ} 59'N$ $24^{\circ} 29'E$ (Adensamer 1898).

Pandalina brevirostris (Rathke 1843)

E of the Peloponnesos, $36^{\circ} 59'N$ $24^{\circ} 29'E$ (Adensamer 1898).

Chlorotocus crassicornis (Costa 1871) (See p. 53)

Isotopus amplissimus Coutière 1907 (See p. 53)

Family CRANGONIDAE

Crangon crangon (Linnaeus 1758)

Phaleron Bay near Athens, Greece (Athanassopoulos 1917, as *C. vulgaris*), Istanbul fish market (Ninni 1923).

Pontophilus spinosus (Leach 1815)

NW of Crete, $35^{\circ} 59'N$ $22^{\circ} 56'E$; E of the Peloponnesos, Greece, $37^{\circ} 0'N$ $24^{\circ} 28'E$, $36^{\circ} 59'N$ $24^{\circ} 29'E$; Sporades, $39^{\circ} 28'N$ $25^{\circ} 37'E$ $36^{\circ} 47'N$ $26^{\circ} 29'E$, and $36^{\circ} 37'N$ $26^{\circ} 43'E$ (Adensamer 1898).

Pontophilus hispidus Westwood 1835 (See p. 54)

Pontocaris cataphracta (Olivi 1792) (See p. 53)

Family POLYCHELIDAE

Polycheles typhlops Heller 1862

E of the Peloponnesos, Greece, $36^{\circ} 40'N$ $23^{\circ} 52'E$; NW of Crete, $36^{\circ} 19'N$ $23^{\circ} 16'E$, and $35^{\circ} 48'N$ $23^{\circ} 34'E$ (Steindachner 1891, Adensamer 1898), NW of Crete, $35^{\circ} 56'N$ $22^{\circ} 55'E$; N of Crete, $36^{\circ} 23'N$ $24^{\circ} 11'E$ (Adensamer 1898), S of Crete, $34^{\circ} 45'N$ $24^{\circ} 23'E$ (Steindachner 1891), off SW Turkey, $36^{\circ} 33'N$ $28^{\circ} 59'E$; N of Egypt, $32^{\circ} 22'N$ $31^{\circ} 45'E$ (Adensamer 1898); W of Alexandria, $31^{\circ} 39'N$ $28^{\circ} 52'E$; N of Cyrenaica, $33^{\circ} 56'N$ $22^{\circ} 56'E$ (Steindachner 1891, Adensamer 1898), N of Cyrenaica, $33^{\circ} 11'N$ $22^{\circ} 23'E$ (Adensamer 1898).

Family PALINURIDAE

Palinurus elephas (Fabricius 1787)

Aristotle (see Thompson, 1910, §549b, lines 17-18, under crawfish, *Palinurus vulgaris*) mentioned this species from Greece: "crawfish in the neighbourhood of Sigeum and Mount Athos". Other records from the E Mediterranean are: Sea of Marmara (Thompson 1912, Ninni 1923), Skiathos, N Sporades (Thompson 1912), Skyros and Kyra Panaghia, N Sporades (Athanassopoulos 1926), Syros, Cyclades (Guérin 1832, as *P. locusta*; Thompson 1912), Possedimento and Furni near Samos (Maldura 1938), Levita, Patmos (=Patmo), Calchi Leros (=Lero), Kos (=Coo), and Episkopi (=Piscopi), Sporades (Maldura 1938), Calchi (Maldura 1938, Tortonose 1947), Smyrna (=Izmir), Turkey (Calman 1912). As pointed out by Gruvel (1928, p. 45; 1929, p. 1698; 1930, p. 38; 1931, p. 115) and Bodenheimer (1935, p. 466), this species does not occur along the coasts of Syria, Israel, and Egypt.

Family SCYLLARIDAE

Scyllarus arctus (Linnaeus 1758) (See p. 54)

Scyllarides latus (Latreille 1803) (See p. 55)

Family NEPHROPSIDAE

Nephrops norvegicus (Linnaeus 1758)

Phaleron Bay near Athens, Greece (Athanasopoulos 1917), Egypt (Holthuis 1945).

Homarus gammarus (Linnaeus 1758)

Aristotle (see Thompson 1910, §549b, lines 16-17, under lobster, *Homarus vulgaris*) recorded the species from Greece: "in the Hellespont [=Dardanelles] and on the coast of Thasos". Other records from the E Mediterranean are: Bosphorus (Ninni 1923), Sea of Marmara (Thompson 1912, Ninni 1923), Skiathos, N Sporades (Thompson 1912), Skyros, N Sporades (Athanasopoulos 1926), market of Athens (Athanasopoulos 1926), Syros, Cyclades (Thompson 1912), Smyrna (=Izmir), Turkey (Calman 1912). According to Maldura (1938) the species does not occur near Rhodes, while Gruvel (1928, 1929, 1930, 1931) and Bodenheimer (1935, p. 466) point to its absence from the Syrian, Israel and Egypt coasts. Three small specimens from Istanbul (no date; G. P. Marsh) are in the collection of the U.S. National Museum, Washington D.C.

Family LAOMEDIIDAE

Jaxea nocturna Nardo 1847 (See p. 55)

Family CALLIANASSIDAE

Callianassa minor Gourret 1887 (See p. 56)

Callianassa tyrrhena (Petagna 1792) (See p. 62)

Callianassa subterranea (Montagu 1808)

Phaleron Bay near Athens, Greece (Athanasopoulos 1917), Benghazi, Cyrenaica (Colosi 1923). The very confused state of the systematics of *Callianassa* makes it quite doubtful whether the specimens on which these records are based, are correctly identified with Leach's species.

Upogebia deltaura (Leach 1815) (See p. 66)

Upogebia pusilla (Petagna 1792).

Gulf of Argolis (=Argos) off Nauplion (=Napoli de Romanie), Greece (Guérin 1832, as *Gebia littoralis*), Crete (Lucas 1853, Raulin 1870, both as *Gebia* (*Thalassina littoralis*), Suez Canal (Monod 1937), near Alexandria, Egypt (Balss 1936).

Upogebia tipica (Nardo 1869) (See p. 65)

Suborder ANOMURA

Family PAGURIDAE

Paguristes oculatus (Fabricius 1775) (See p. 67)

Clibanarius erythropus (Latreille 1818) (See p. 67)

Calcinus ornatus (P. Roux 1830) (See p. 68)

Diogenes pugilator (P. Roux 1829) (See p. 68)

Dardanus arrosor (Herbst 1796) (See p. 69)

Dardanus callidus (Risso 1827) (See p. 69)

Pagurus bernhardus (Linnaeus 1758)

Peloponnesos, Greece (Guérin 1832). This record probably is based on specimens of a different species, possibly *P. prideauxi* Leach.

Pagurus sculptimanus Lucas 1846 (See p. 70)

Pagurus spinimanus Lucas 1846 (See p. 70)

Pagurus alatus Fabricius 1775 (See p. 71)

Pagurus prideauxi Leach 1815 (See p. 71)

Pagurus anachoretus Risso 1827 (See p. 71)

Catapaguroides timidus (P. Roux 1830) (See p. 72)

Anapagurus laevis (Bell 1846) (See p. 72)

Anapagurus bicorniger A. Milne Edwards and Bouvier 1892 (See p. 73)

Family GALATHEIDAE

Galathea intermedia Lilljeborg 1851 (See p. 73)

Galathea strigosa (Linnaeus 1761)

Cape Tainaron and Marathonesi, S Greece (Guérin 1832), Rhodes (Tortonese 1947).

Galathea squamifera Leach 1814 (See p. 73)

Galathea squamifera Leach 1814 (See p. 73)

S end of Bosphorus, and near Marmara Island, Sea of Marmara (Ostroumoff 1896).
Sporades, 37° 37'N 26° 58'E (Adensamer 1898), Gulf of Alexandretta (=Iskenderon)
Turkey (Monod 1931).

Munida rugosa (Fabricius 1775)

E of the Peloponnesos, Greece, 36° 58'N 24° 18'E and 36° 59'N 24° 29'E (Adensamer 1898, as *M. bamffica*), near Marmara Island, Sea of Marmara (Ostroumoff 1896).

Munida tenuimana Sars 1871

Near Ocsia, E Sea of Marmara (Ostroumoff 1896).

Munida curvimana A. Milne Edwards and Bouvier 1894 (See p. 74).

Family PORCELLANIDAE

Porcellana longicornis (Linnaeus 1767) (See p. 76)

Porcellana platycheles (Pennant 1777) (See p. 77)

Petrolisthes boscii (Audoin 1826)

Pylos, Methone (=Modon), and Gulf of Argolis (=Argos), S Greece (Guérin 1832).
It seems very improbable that Guérin's specimens actually belong to this species, which is known only from the Indo-West Pacific region. Without examination of the original material, little can be said about its identity.

Family ALBUNEIDAE

Albunea carabus (Linnaeus 1758) (See p. 77).

Suborder BRACHYURA

Family DROMIIDAE

Dromia personata (Linnaeus 1758) (See p. 78)

Family HOMOLIDAE

Homola barbata (Fabricius 1793) (See p. 78)

Paramola cuvieri (Risso 1816)

Methana peninsula, Gulf of Aigina, S Greece (Guérin 1832).

Family DORIPPIDAE

Dorippe lanata (Linnaeus 1767) (See p. 78)

Ethusa mascarone (Herbst 1785) (See p. 79)

Family CALAPPIDAE

Calappa granulata (Linnaeus 1767) (See p. 79)

Family LEUCOSIIDAE

Ebalia nux A. Milne Edwards 1881

W of the Peloponnesos, Greece, 37° 14'N 21° 2'E; NW of Crete, 35° 59'N 22° 56'E
36° 7'N 23° 8'E, 35° 48'N 23° 34'E, E of the Peloponnesos, 36° 40'N 23° 52'E, 36° 58'N

24° 18'E, 36° 59'N 24° 29'E; N of Crete, 36° 9'N 25° 50'E, 36° 23'N 24° 11'E, 36° 25'N 24° 24'E; N Aegean, 40° 8'N 24° 42'E; Sporades, 36° 47'N 26° 29'E, 36° 37'N 26° 43'E; N of Cyprus, 35° 57'N 32° 51'E; N of Cyrenaica, 33° 56'N 22° 56'E (Adensamer 1898).

Ebalia granulosa H. Milne Edwards 1837 (See p. 79)

Ebalia cranchii Leach 1817 (See p. 80)

Ebalia tuberosa (Pennant 1777)

NW. of Crete, 36° 3'N 23° 6'E (Adensamer 1898).

Merocryptus boletifer A. Milne Edwards and Bouvier 1894

NW of Crete, 36° 3'N 23° 6'E (Adensamer 1898).

Myra fugax (Fabricius 1798) (See p. 81)

Leucosia signata Paulson 1875 (See p. 81)

Philyra globulosa (Bosc 1801)

Phaleron Bay near Athens, Greece (Athanasopoulos 1917). Athanasopoulos recorded this Indo-West Pacific species to be "assez commun" in Phaleron Bay. This record must be considered with a great deal of reserve, since the species has neither before nor afterwards been reported from outside the Indo-West Pacific region.

Ilia nucleus (Linnaeus 1758) (See p. 82)

Ixa monodi Holthuis and Gottlieb 1956

Mersin Bay, SE Turkey (Holthuis and Gottlieb 1956).

Family CORYSTIDAE

Corystes cassivelaunus (Pennant 1777)

Scarpanto, Aegean Sea (Santucci 1928).

Family CANCRIDAE

Cancer pagurus Linnaeus 1758

Peloponnesos, Greece (Guérin 1832)

Family PIRIMELIDAE

Pirimela denticulata (Montagu 1808) (See p. 82)

Family PORTUNIDAE

Carcinus mediterraneus Czerniavsky 1884 (See p. 82).

Portumnus latipes (Pennant 177) (See p. 85)

Xaiva biguttata (Risso 1816) (See p. 85)

Macropipus arcuatus (Leach 1814)

Phaleron Bay near Athens, Greece (Athanasopoulos 1917, as *Portunus rondeletii*), S end of Bosphorus, near Princes Islands (=Kizil Adalar), and near Gallipoli, Sea of Marmara (Ostroumoff 1896), Kos (=Coo), Sporades (Santucci 1928), Rhodes (Santucci 1928, Tortonese 1947), Egypt (Audouin 1826, as *Portunus Rondeleti*), near Alexandria, Egypt (Balss 1936), Tolmeta, Cyrenaica (Colosi 1923).

Macropipus puber (Linnaeus 1767)

Phaleron Bay near Athens, Greece (Athanasopoulos 1917).

Macropipus corrugatus (Pennant 1777)

S end of Bosphorus, Sea of Marmara (Ostroumoff 1896), Rhodes (Tortonese 1947), Suez Canal: Great Bitter Lake (Holthuis 1956).

Macropipus parvulus (Parisi 1915) (See p. 86).

Macropipus pusillus (Leach 1815) (See p. 86).

Macropipus vernalis (Risso 1816) (See p. 86).

Macropipus holsatus (Fabricius 1798).

Near Marmara Island, Sea of Marmara (Ostroumoff 1896).

Macropipus marmoreus (Leach 1814)

St. Georges Bay, Beirut, Lebanon (Monod 1931). It is possible that the E Mediterranean specimens referred to in the literature as *Portunus* (= *Macropipus*) *marmoreus* and *P. hirsutus* actually belong to *M. vernalis*.

Macropipus depurator (Linnaeus 1758) (See p. 88)*Macropipus tuberculatus* (Roux 1830)

NW of Crete, 35° 59'N 22° 56'E; E of the Peloponnesos, Greece, 36° 40'N 23° 52'E (Steindachner 1891, Adensamer 1898), Cyclades, 36° 59'N 24° 29'E (Adensamer 1898).

Bathynectes longipes (Risso 1816)

Phaleron Bay near Athens, Greece (Athanasopoulos 1917), near Princes Islands (= Kizil Adalar) and near Gallipoli, Sea of Marmara (Ostroumoff 1896).

Bathynectes superba (Costa 1853)

NW of Crete, 35° 45'N 23° 11'E; E of the Peloponnesos, 36° 58'N 24° 18'E (Adensamer 1898).

Charybdis hellerii (A. Milne Edwards 1867) (See p. 88).*Charybdis sexdentata* (Herbst 1783) (See p. 89)*Thalamita admete* (Herbst 1803)

Gulf of Aigina near Methana Peninsula, S Greece (Guérin 1832).

Thalamita poissonii (Audoin 1826) (See p. 89)*Callinectes sapidus* Rathbun 1896 (See p. 91)*Portunus hastatus* (Linnaeus 1767) (See p. 91)*Portunus pelagicus* (Linnaeus 1758) (See p. 92)

Family XANTHIDAE

Xantho poressa (Olivi 1792) (See p. 92)*Xantho granulicarpus* Forest 1953 (See p. 93)*Medaesus couchi* (Couch 1851)

NW of Crete, 35° 48'N 23° 34'E, 35° 59'N 22° 56'E, and 36° 7'N 23° 8'E; N of Crete, 36° 26'N 25° 24'E; E of the Peloponnesos 36° 40'N 23° 52'E, and 36° 59'N 24° 29'E; Sporades, 36° 47'N 26° 29'E, and 37° 37'N 26° 58'E; N Aegean Sea, 39° 28'N 25° 37'E (Adensamer 1898, as *Xantho tuberculata*), near Kalolimno (=Imralü) Island near Eregli, and near Marmara Island, Sea of Marmara (Ostroumoff 1896, as *X. tuberculata*).

Micropanope rufopunctata (A. Milne Edwards 1869) (See p. 94)*Actaea rufopunctata* (H. Milne Edwards 1834)

Near Alexandria, Egypt (Balss 1936), Mersin Bay, SE Turkey (Holthuis and Gottlieb 1956).

Pilumnopus vanquelinii (Audouin 1826) (See p. 96)*Heteropanope laevis* (Dana 1852)

Port Said, Egypt (Calman 1927, Fox 1927), Suez Canal (Calman 1927, Fox 1927, Gruve 1936, Monod 1937, 1938).

Pilumnus birtellus (Linnaeus 1761) (See p. 96)*Pilumnus spinifer* H. Milne Edwards 1834 (See p. 97)*Pilumnus hirsutus* Stimpson 1858

Near Alexandria, Egypt (Balss 1936).

Eriphia verrucosa (Forsk. 1775) (See p. 98).

Family GONEPLACIDAE

Geryon tridens Kröyer 1837

E part of Sea of Marmara (Ostroumoff 1896).

Eucrate crenata (De Haan 1835)

Port Said, Egypt (Calman 1927, Fox 1927), Suez Canal (Calman 1927, Fox 1927, Monod 1937, 1938, Tortonesi 1947b, 1952, Holthuis 1956), near Alexandria (Balss 1936).

Goneplax rhomboides (Linnaeus 1758) (See p. 99)

Family OCYPODIDAE

Ocypode cursor (Linnaeus 1758) (See p. 99).

Family GRAPSIDAE

Pachygrapsus marmoratus (Fabricius 1787) (See p. 100)

Pachygrapsus transversus (Gibbes 1850) (See p. 101)

Planes minutus (Linnaeus 1758) (See p. 102)

Brachynotus sexdentatus (Risso 1827) (See p. 102)

Family PINNOTHERIDAE

Pinnotheres pisum (Linnaeus 1767) (See p. 103)

Pinnotheres pinnotheres (Linnaeus 1758)

Sapientza, S. Greece (Guérin 1832, as *P. veterum*), ? Phaleron Bay near Athens, Greece (Athanassopoulos 1917, see also p. 104), Istanbul and Smyrna (=Izmir), Turkey (Forskal 1775).

Family PALICIDAE

Palicus caronii (P. Roux 1830) (See p. 104)

Family PARTHENOPIDAE

Lambrus angulifrons (Latreille 1825) (See p. 104)

Lambrus macrochelos (Herbst 1790) (See p. 104)

Lambrus massena Roux 1830 (See p. 105)

Lambrus expansus Miers 1879

NW of Crete, 36° 3'N 23° 6'E (Adensamer 1898).

Family MAJIDAE

Maja squinado (Herbst 1788) (See p. 105)

Maja verrucosa H. Milne Edwards 1834 (See p. 105)

Maja goetziana Oliveira 1888 (See p. 106)

Pisa tetraodon (Pennant, 1777) (See p. 108, under *P. muscosa*)

Pisa corallina (Risso, 1816) (See p. 108, under *P. muscosa*)

Pisa muscosa (Linnaeus 1758) (See p. 106)

Pisa nodipes Leach 1815 (See p. 107)

Pisa armata (Latreille 1803)

Phaleron Bay near Athens, Greece (Athanassopoulos 1917, as *P. armata* and *P. Gibbsii*), near Princes Islands (=Kizil Adalar), E Sea of Marmara (Ostroumoff 1896, as *P. Gibbsii*).

Eurynome aspera (Pennant 1777) (See p. 108)

Ergasticus clouei A. Milne Edwards 1881

N of Crete, 36° 26'N 25° 24'E (Steindachner 1891, Adensamer 1898), Sporades, 36° 47'N 26° 29'E; N of Cyprus, 35° 57'N 32° 51'E (Adensamer 1898).

Acanthonyx lunulatus (Risso 1816) (See p. 108)

Dorynchus thomsoni Thomson 1873

S of the Peloponnesos, Greece, 36° 27'N 22° 18'E; Cyclades, 36° 40'N 23° 52'E, 36° 25'N 24° 2'E, 36° 54'N 24° 7'E, 36° 23'N 24° 11'E, 36° 58'N 24° 18'E, 36° 25'N 24° 2'E, 37° 37'N 24° 33'E; N of Cyrenaica, 33° 56'N 22° 56'E (Adensamer 1898, as *Lispognathus thomsoni*).

Inachus dorsettensis (Pennant 1777) (See p. 108)

Inachus phalangium (Fabricius, 1775)

Near Alexandria, Egypt (Balss 1936, as *I. dorynchus*)

Inachus leptochirus Leach 1817

NW of Crete, 36° 3'N 23° 6'E (Adensamer 1898), S end of Bosphorus, near Marmara Island, and near Gallipoli, Sea of Marmara (Ostroumoff 1896).

Inachus thoracicus Roux 1830

Sapientza, S Greece (Guérin 1832), Phaleron Bay near Athens (Athanassopoulos 1917), E coast of Pasha-Liman (=Aloni) Island, Sea of Marmara (Ostroumoff 1896).

Achaeus cranchii Leach 1817

Bay of Aromata, S Greece, 36° 23'N 22° 29'E (Adensamer 1898), Phaleron Bay near Athens, Greece (Athanassopoulos 1917), near Alexandria, Egypt (Balss 1936).

Macropodia rostrata (Linnaeus 1761) (See p. 109)

Macropodia longirostris (Fabricius 1775) (See p. 109)

Macropodia longipes (A Milne Edwards and Bouvier 1894) (See p. 110)

REFERENCES

1. ADENSAMER, T., 1898, Decapoden. Gesammelt auf S. M. Schiff Pola in den Jahren 1890-1894. Zoologische Ergebnisse. XI. Berichte der Commission für Erforschung des östlichen Mittelmeeres. XXII. Denkschr. Akad. Wiss. Wien, 65, 597-628. 1 textfigure.
2. AHARONI, I., 1937, Données zoogéographiques sur la Faune de la Palestine et des Contrées adjacentes par rapport à celle de la Péninsule Ibérique. C.R. 12th. Int. Congr. Zool. 2, (= Arg. Mus. Bocage, 6A), 1132-1137.
3. AHARONI, I., 1944, Animals hitherto unknown to or little known from Palestine. Bull. zool. Soc. Egypt, 6 (Syria/Palestine suppl.), 40-41.
4. ALCOCK, A., 1906, The prawns of the Peneus group. Catalogue of the Indian Decapoda Crustacea in the collection of the Indian Museum. III. Macrura. I, i-ii, 1-55, plates 1-9.
5. ATHANASSOPOULOS, G. D., 1917, Quelques éléments de recherches hydrobiologiques en Grèce, 1-40, plates 1-8.
6. ATHANASSOPOULOS, G. D., 1926, Notes sur la faune marine de la Grèce. Bull. Inst. océanogr. Monaco, (480), 1-7.
7. AUDOUIN, V., 1826, Explication sommaire des planches de Crustacés de l'Égypte et de la Syrie, publiées par Jules-César Savigny, membre de l'Institut; offrant un exposé des caractères naturels des genres avec la distinction des espèces. Description de l'Égypte ou recueil des observations et des recherches qui ont été faites en Égypte pendant l'expédition de l'armée française. Hist. nat., 1 (4), 77-98.
8. BALSS, H., 1921 Stomatopoda, Macrura, Paguridea und Galatheida. In: Resultate of Dr. E. Mjöberg's Swedish Scientific Expeditions to Australia 1910-13. XXIX. K. Svenska Vetensk. Akad. Handl., 61 (10), 1-24, textfigures 1-12.
9. BALSS, H., 1927, Bericht über die Crustacea Decapoda (Natantia und Anomura). Zoological Results of the Cambridge Expedition to the Suez Canal, 1924. XIV. Trans. zool. Soc. Lond., 22, 221-227.
10. BALSS, H., 1936, Decapoda. The fishery grounds near Alexandria. VII. Not. Mem. Fish. Res. Direct. Egypt, (15), 1-67, figures 1-40.
11. BANNER, A. H., 1953, The Crangonidae, or Snapping Shrimp, of Hawaii. Pacific Science, 7, 2-144, 147, figures 1-50.
12. BELL, T., 1844-53, A History of the British Stalk-Eyed Crustacea, i-lxv, 1-386, 174 textfigures.
13. BODENHEIMER, F. S., 1920, Die Tierwelt Palästinas. II. In: Hölscher, G., Das Land der Bibel, 3 (4), 1-38.
14. BODENHEIMER, F. S., 1935, Animal Life in Palestine. An introduction to the problems of animal ecology and zoogeography, 1-506, textfigures 1-77, plates 1-70.
15. BODENHEIMER, F. S., 1937, Prodromus Faunae Palaestinae. Essai sur les éléments zoogéographiques et historiques du sud-ouest du sous-règne paléarctique. Mém. Inst. Égypte, 33, i-ii, 1-286, figures 1-4.
16. BORRADAILE, L. A., 1903, On the classification of the Thalassinidea. Ann. Mag. nat. Hist., ser. 7, 12, 534-551, 638.
17. BOUVIER, E. L., 1940, Décapodes marcheurs. Faune de France, 37, 1-404, textfigures 1-222, plates 1-14.
18. BURKENROAD, M. D., 1934, Littoral Penaeidea chiefly from the Bingham Oceanographic Collection. With a revision of Penaeopsis and descriptions of two new genera and eleven new American species. Bull. Bingham oceanogr. Coll., 4 (7), 1-109, figures 1-40.
19. CALMAN, W. T., 1912, Lobsters in the Aegean. Nature, Lond., 89, 529.
20. CALMAN, W. T., 1927, Report on the Crustacea Decapoda (Brachyura). Zoological Results of the Cambridge Expedition to the Suez Canal, 1924. XIII. Trans. zool. Soc. Lond., 22, 211-217.

21. CARMIN, J., 1955, Some additional notes on the fauna of the tidal zone of our Mediterranean and Red Sea. *Bull. Indep. biol. Lab. Kfar Malal*, 11 (1), 1-4.
22. CHACE, F. A., 1951, The oceanic crabs of the genera *Planes* and *Pachygrapsus*. *Proc. U. S. Nat. Mus.*, 101, 65-103, figures 1-8.
23. CHILTON, C. and BENNETT, E. W., 1929, Contributions for a revision of the Crustacea Brachyura of New Zealand. *Trans. New Zeal. Inst.*, 59, 731-778.
24. COCCO, A., 1833, Descrizione di alcuni Crustacei di Messina. *Giorn. Sci. Lett. Arti Sicilia*, 44, 107-115, plate 1, figures 1-3.
25. COLOSI, G., 1923, Crostacei Decapodi della Cirenaica. *Mem. R. Com. Talassogr. Ital.*, (104), 1-11.
26. COSTA, O. G., 1840, Catalogo de' Crostacei del Regno di Napoli Distribuiti secondo il metodo di Latreille, in Cuv. Regn. An. ed. 2. In: Costa, O. G., Fauna del Regno di Napoli ossia Enumerazione di tutti gli animali che abitano le diverse regioni di questo regno e le acque che le bagnano contenente la descrizione de nuovi o poco esattamente conosciuti. Crostacei ed Aracnedi, pt. 2, pp. 1-7.
27. COUTIERE, H., 1899, Les "Alpheidae", morphologie externe et interne, formes larvaires, bionomie. *Ann. Sci. nat. Zool.*, ser. 8, 9, 1-559, textfigures 1-409, plates 1-6, 1 map.
28. COUTIERE, H., 1905, Les Alpheidae. In: Gardiner, J. S., *The Fauna and Geography of the Maldive and Laccadive Archipelagoes*. Being the account of the work carried on and of the collections made by an expedition during the years 1899 and 1900, 2 (4), 852-918, plates 70-79.
29. COUTIERE, H., 1901, Sur quelques formes larvaires énigmatiques d'Eucyphotes, provenant des collections de S.A.S. le prince de Monaco. *Bull. Inst. océanogr. Monaco*, (104), 1-70, figures 1-22.
30. CZERNIAVSKY, V., 1884, Crustacea Decapoda Pontica littoralia. Materialia and Zoographiam Ponticam comparatam. II. *Trans. Soc. Univ. Kharkow*, 13 suppl. 1-268, pls. 1-7.
31. DEMEUSY, N. and VEILLET, A., 1953, Sur l'existence de deux populations de *Carcinus maenas* Pennant et sur les caractères morphologiques qui les distinguent. *C. R. Acad. Sci. Paris*, 236, 1088-1090.
32. DRACH, P. and FOREST, J., 1953, Description et répartition des Xantho des mers d'Europe. Travaux de la Station Biologique de Roscoff. XIII. *Arch. Zool. expér. gén.*, 90, 1-36, figures 1-24, tables 1-3.
33. DUBOSCQ, O. and TUZET, O., 1934, Sur un crabe mal connu, *Brachynotus gemmellari* Rizza (*Heterograpsus lucasi* Milne-Edw.). *C. R. Soc. Biol. Paris*, 117, 418-420.
34. FABRICIUS, J. C., 1798, *Supplementum Entomologiae systematicae*, 1-572.
35. FENIZIA, G., 1937, Specie e varietà dei generi *Catapaguroides* M. Edwards e Bouvier, *Anapagurus* Henderson e *Nematopagurus* M. Edwards e Bouvier. I Paguridi del golfo di Napoli. II. *Annu. Mus. Zool. Univ. Napoli*, n. ser., 7 (2), 1-40, figures 1-27.
36. FOREST, J., 1955, Crustacés Décapodes, Pagurides. *Rés. sci. Expéd. océanogr. Belge Atlantique Sud*, 3 (4), 21-147, textfigures 1-32, plates 1-6.
37. FOREST, J., 1957, Mise au point sur les *Brachynotus* de Méditerranée et d'Afrique occidentale: *Brachynotus sexdentatus* Risso et *Brachynotus atlanticus* nov. sp. *Bull. Inst. Franc. Afr. Noire*, 19A (2) 501-510, figures 1-14.
38. FOREST, J. 1957a, Une réunion carcinologique à Barcelone. *Bull. Mus. Hist. Nat. Paris*, ser. 2, 29, 421-427.
39. FOREST, J. and GUINOT, D., 1956, Sur une collection de Crustacés Décapodes et Stomatopodes des mers tunisiennes. *Bull. Sta. océanogr. Salammbô*, (53), 24-43, figures 1-5, 1 chart.
40. FORSKAL, P., 1775, *Descriptiones Animalium, Avium, Amphibiorum, Piscium, Insectorum, Vermium*, 1-19, i-xxxii, 1-164.
41. FOX, H. M., 1924, The migration of a Red Sea crab through the Suez Canal. *Nature, Lond.*, 113, 714, 715.
42. FOX, H. M., 1926, General Part. Zoological Results of the Cambridge Expedition to the Suez Canal, 1924. I. *Trans. zool. Soc. Lond.*, 22, 1-64, tables 1-16, maps 1-5, figures 1-3.
43. FOX, H. M., 1927, Appendix to the Report on the Crustacea Decapoda (Brachyura). Zoological Results of the Cambridge Expedition to the Suez Canal, 1924. *Trans. zool. Soc. Lond.*, 22, 217-219.

44. FOX, H. M., 1927a, Appendix II to the Report on the Crustacea Decapoda (Natantia and Anomura). Zoological Results of the Cambridge Expedition to the Suez Canal 1924. *Trans. zool. Soc. Lond.*, 22, 229, 230.
45. GIORDANI SOIKA, A., 1951, *Il Neptunus pelagicus* (L.) nell' alto Adriatico. *Natura Milano*, 42, 18-20, 1 figure.
46. GORDON, I., 1938, A comparison of the two genera *Albunea* and *Lepidopa* (Crustacea Anomura), with description of a new species from Singapore. *Bull. Raffles Mus.*, (14), 186-197, textfigures 1-5, plate 29.
47. GOTTLIEB, E., 1953, Decapod Crustaceans in the Collection of the Sea Fisheries Research Station, Caesarea, Israel. *Bull. Res. Counc. of Israel*, 2, 440-441.
48. GOURRET, P., 1887, Sur quelques Décapodes macroures nouveaux du golfe de Marseille. *C. R. Acad. Sci. Paris*, 105, 1033-1035.
49. GOURRET, P., 1887a, La faune des Crustacés podophthalmes du golfe de Marseille. *C. R. Acad. Sci. Paris*, 105, 1132-1135.
50. GOURRET, P., 1888, Révision des Crustacés Podophthalmes du golfe de Marseille, suivie d'un essai de classification de la classe des Crustacés. *Mém. Mus. Hist. nat. Marseille*, 3 (5), 1-212, plates 1-18.
51. GRUVEL, A., 1928, Répartition géographique de quelques Crustacés comestibles sur les côtes d'Egypte et de Syrie. *C. R. Soc. Biogeogr. Paris*, 5 (39), 45-46.
52. GRUVEL, A., 1929, De l'influence du percement du canal de Suez sur la faune marine des côtes de Syrie. *C. R. Acad. Sci. Paris*, 188, 1697-1699.
53. GRUVEL, A., 1930, Les Richesses marines et fluviales de Syrie. Exploitation actuelle-Avenir. *Rev. sci.*, 68, 33-41, figures 1-10.
54. GRUVEL, A., 1930a, Sur les principales zones chalutables de la Méditerranée orientale. Carte de pêche du golfe d'Alexandrette. *C. R. Acad. Sci. Paris*, 190, 477-479.
55. GRUVEL, A., 1931, Partie générale et économique. In: Gruvel, A., Les États de Syrie. Richesses marines et fluviales. Exploitation actuelle-Avenir. *Bibl. Faune Colon. France*, 3, 1-453, textfigures 1-56, plates 1-28.
56. GRUVEL, A., 1936, Contribution à l'étude de la bionomie générale et de l'exploitation de la faune du Canal de Suez. *Mém. Inst. Egypte*, 29, i-vii, 1-255, textfigures 1-62, plates 1-25, 1 map.
57. GUERIN-MENEVILLE, F. E., 1832, 1re Classe. Crustacés. In: Brullé, A., Des animaux articulés. *Expédition scientifique de Morée. Section des sciences physiques*, 3 (1), (Zool.) sect. 2, 30-50, plate 27.
58. GURNEY, R., 1927, Appendix I to the Report on the Crustacea Decapoda (Natantia and Anomura). Zoological Results of the Cambridge Expedition to the Suez Canal, 1924. *Trans. zool. Soc. Lond.*, 22, 228-229.
59. GURNEY, R., 1927a, Report on the larvae of the Crustacea Decapoda. Zoological Results of the Cambridge Expedition to the Suez Canal, 1924. XV. *Trans. zool. Soc. Lond.*, 22, 231-286, figures 49-76.
60. GURNEY, R., 1927b, Report on the species of Hippolyte. Zoological Results of the Cambridge Expedition to the Suez Canal, 1924. XXVI. *Trans. zool. Soc. Lond.*, 22, 391-397, figures 94-100.
61. HANSEN, H. J., 1922, Crustacés décapodes (Sergestides) provenant des Campagnes des yachts Hironnelle et Princesse-Alice (1885-1915). *Rés. Camp. sci. Monaco*, 64, 1-232, plates 1-11.
62. HASSELQUIST, F., 1757, *Iter Palaestinum Eller Resa Til Heliga Landet, förrättad ifran Ar 1749 til 1752, Med Beskrifningar, Rön, Anmärkningar, Öfver de märkvärdigaste Naturalier, Pa Hennes Kongl. Maj: ts Befallning, Utgiven af Carl Linnaeus*, 14, pp. 1-619.
63. HELLER, C., 1863, Die Crustaceen des südlichen Europa. Crustacea Podophthalmia. Mit einer Uebersicht über die horizontale Verbreitung sämtlicher europäischer Arten, I-XI, 1-336, plates 1-10.
64. HEMMING, A. F., 1950, The official Record of Proceedings of the International Commission on Zoological Nomenclature at their Session held in Paris in July, 1948. *Bull. zool. Nomencl.*, 4, 1-760.
65. HOLTHUIS, L. B., 1945, Remarks on *Nephrops norvegicus* (L.) and its variety *meridionalis* Zariquiey. *Zool. Meded.*, 25, 317-320, figure 1.

66. HOLTHUIS, L. B., 1947, Nomenclatorial notes on European Macrurous Crustacea Decapoda. *Zool. Meded.*, 27, 312-322, figure 1.
67. HOLTHUIS, L. B., 1950, The Palaemonidae collected by the Siboga and Snellius Expeditions with remarks on other species. I. Subfamily Palaemoninae. The Decapoda of the Siboga Expedition. Part X. *Siboga Exped., mon.* 39a9, 1-268, figures 1-52.
68. HOLTHUIS, L. B., 1951, The Caridean Crustacea of Tropical West Africa. *Atlantide Rep.*, 2, 7-187, figures 1-34.
69. HOLTHUIS, L. B., 1954, The names of the European species of the genus *Xantho* Leach, 1814 (Crustacea Decapoda Brachyura). *Proc. Kon. Nederl. Akad. Wetensch.*, ser. C 57, 103-107.
70. HOLTHUIS, L. B., 1956, Notes on a collection of Crustacea Decapoda from the Great Bitter Lake, Egypt, with a list of the species of Decapoda known from the Suez Canal. *Zool. Meded. Leiden*, 34, 301-330, figures 1-3.
71. HOLTHUIS, L. B., 1957, Proposed use of the plenary powers (a) to suppress the specific name *squilla* Linnaeus, 1758, as published in the combination *Cancer squilla*, and (b) to substitute the name *Palaemon adspersus* Rathke, 1837, as the name to be cited as that of the type species of the genus *Palaemon* Weber, 1795 (Class Crustacea, Order Decapoda). *Bull. zool. Nomencl.*, 13, 142-153.
72. HOLTHUIS, L. B. and GOTTLIEB, E., 1955, The occurrence of the American Blue Crab, *Callinectes sapidus* Rathbun, in Israel Waters. *Bull. Res. Council of Israel*, 5B, 154-156.
73. HOLTHUIS, L. B. and GOTTLIEB, E., 1956, Two interesting crabs (Crustacea Decapoda, Brachyura) from Mersin Bay, S.E. Turkey. *Zool. Meded. Leiden*, 34, 287-299, textfigures 1-2, plates 4-5.
74. HOPE, F. G., 1851, *Catalogo dei Crostacei Italiani e di molti altri del Mediterraneo*. 1-48, 1 plate.
75. KAISER, A., 1889, Verzeichnis ägyptischer Thiere beobachtet vom 1. Juli 1885 bis 1. Juli 1887. *Ber. St. Gall. naturwiss. Ges.* 1887-88, 160-192.
76. KELLER, C., 1883, Die Fauna im Suez-Kanal und die Diffusion der mediterranen und erythräischen Thierwelt. Eine thiergeographische Untersuchung. *Neue Denkschr. Schweiz. Ges. ges. Naturwiss.*, 28, (=ser. 3, 8) pt 3 (1), 1-39, plates 1-2.
77. KEMP, S., 1922, Pontoninae. Notes on Crustacea Decapoda in the Indian Museum. *XV. Rec. Indian Mus.*, 24, 113-288, textfigures 1-105, plates 3-9.
78. KEMP, S., 1925, On various Caridea. Notes on Crustacea Decapoda in the Indian Museum. *XVII. Rec. Indian Mus.*, 27, 249-343, figures 1-24.
79. KINGSLEY, J. S., 1880, Synopsis of the Grapsidae. Carcinological Notes, IV. *Proc. Acad. nat. Sci. Phila.*, 187-224.
80. KOENIG, A., 1895, Die Sergestiden des östlichen Mittelmeeres, gesammelt 1890, 1891, 1892, 1893. Zoologische Ergebnisse. IV. Berichte der Commission für Erforschung des östlichen Mittelmeeres. XIII. *Denkschr. Akad. Wiss. Wien*, 62 (2), 1-18, plates 1-5.
81. KRUKENBERG, C. F. W., 1888, Die Durchfluthung des Isthmus von Suez in chorologischer, hydrographischer und historischer Beziehung. Wissenschaftliche Ergebnisse meiner Reise vom Étang de Berre über Marseille und Triest nach Suakim und Massaua. II. Theil. In: Krukenberg, C. F. W., Vergleichend — physiologische Studien. *Experimentelle Untersuchungen*, ser. 2, 5 (1), 1-156, plates 1-2.
82. KUBO, I., 1949, Studies on Penaeids of Japanese and its adjacent Waters. *Journ. Tokyo Coll. Fish.*, 36, 1-467, figures 1-160.
83. LAMARCK, J. B. P. A. de, 1818, *Histoire naturelle des Animaux sans Vertèbres, présentant les caractères généraux et particuliers de ces animaux, leur distribution, leurs classes, leurs familles, leurs genres, et la citation des principales espèces qui s'y rapportent; précédée d'une Introduction offrant la Détermination des caractères essentiels de l'Animal, sa distinction du végétal et des autres corps naturels, enfin, l'Exposition des Principes fondamentaux de la Zoologie*, 5, 1-612.
84. LAMOUROUX, J. V. F., 1816, *Histoire des polypiers coralligènes flexibles, vulgairement nommés Zoophytes*, 560 pp., 19 plates.
85. LEENE, J., 1938, Brachygnatha: Portunidae. The Decapoda Brachyura of the Siboga Expedition. VII. *Siboga Exped., mon.* 39c3, 1-156, figures 1-87.
86. LINNAEUS, C., 1747, Wästgöta-Resa, Pa Riksens Högloflige Ständers Befallning örrättad år 1746. Med Anmärkningar uti Oeconomien, Naturkunnoheten, Antiqui-

- teter, Inwanarnes Seder och Lefnads-Sätt, Med Tilhörige Figurer, i-xvi, 1-284, textfigurer, plates 1-5.
87. LINNAEUS, C., 1758, *Systema Naturae Per Regna Tria Naturae, Secundum Classes, Ordines, Genera, Species, Cum Characteribus, Differentiis, Synonymis, Locis*, ed. 10 vol. 1, pp. 1-824, i-iii.
 88. LUCAS, H., 1846, Crustacés, Arachnides, Myriopodes et Hexapodes. Exploration scientifique de l'Algérie pendant les années 1840, 1841, 1842. Sciences physiques. Zoologie I. Histoire naturelle des Animaux articulés pt. 1, 1-403, plates 1-8.
 89. LUCAS, H., 1853, Crustacea. Essai sur les animaux articulés qui habitent l'île de Crète. *Rev. Mag. Zool.*, ser. 2, 5, 461-468, plate 16, figure 1.
 90. MALDURA, C. M., 1938, La pesca nelle Isole Italiane dell' Egeo. *Boll. Pesca Piscicoltura Idrobiol. Roma*, 14, 460-481, figures 1-7, 2 maps.
 91. MAN, J. G. de, 1911, The Decapoda of the Siboga Expedition. Part II. Family Alpheidae. *Siboga Exped.*, mon. 39al, 133-465, mon. 39al, suppl. (1915), plates 1-23.
 92. MAN, J. G. de, 1920, The Decapoda of the Siboga Expedition. Part IV. Families Pasi-phaeidae, Stylodactylidae, Hoplophoridae, Nematocarcinidae, Thalassocaridae, Pandalidae, Psalidopodidae, Gnathophyllidae, Processidae, Glyphocrangonidae and Crangonidae. *Siboga Exped.*, mon. 39a3, 1-318, plates 1-25.
 93. MAN, J. G. de, 1923, *Leander longirostris* (H.M.-Edw.) var. *robusta* nov. var., the Common Prawn of the estuary of the Meuse and of the Hollandsch Diep. *Tijdschr. Nederl. dierk. Ver.*, ser. 2, 19, 1-9, figures A-B.
 94. MAN, J.G. de, 1927, A contribution to the knowledge of twenty-one species of the genus *Upogebia* Leach. *Capita Zool.*, 2 (5), 1-58, plates 1-6.
 95. MAN, J. G. de, 1928, The Thalassinidae and Callianassidae collected by the Siboga Expedition with some remarks on the Laomedidae. The Decapoda of the Siboga Expedition. Part VII. *Siboga Exped.*, mon. 39a6, 1-187, plates 1-20.
 96. MILNE EDWARDS, A. and BOUVIER, E. L., 1900, Crustacés Décapodes. Première Partie. Brachyours et Anomours. *Expéditions scientifiques du Travailleur et du Talisman pendant les années 1880, 1881, 1882, 1883*, 1-396, plates 1-32.
 97. MILNE EDWARDS, H., 1834, *Historie naturelle des Crustacés, comprenant l'anatomie, la physiologie et la classification de ces animaux*, 1, i-xxxv, 1-468.
 98. MILNE EDWARDS, H., 1853, Mémoire sur la famille des Ocypodiens, suite. *Ann. Sci. nat. Zool.*, ser. 3, 20, 163-228, plates 6-11.
 99. MONOD, T., 1930, Ueber einige indo-pazifische Decapoden der Meeresfauna Syriens. *Zool. Anz.*, 92, 135-141, figures 1-8.
 100. MONOD, T., 1931, Crustacés de Syrie. In: Gruvel, A., Les États de Syrie. Richesses marines et fluviales. Exploitation actuelle — Avenir. *Bibl. Faune Colon. Franc.*, 3, 397-435, figures 1-27.
 101. MONOD, T., 1932, Crustacés exotiques en Méditerranée. *La Terre et la Vie*, 2, 65-73, 10 figures.
 102. MONOD, T., 1937, Crustacés. Missions A. Gruvel dans le Canal de Suez. I. *Mém. Inst. Égypte*, 34, 1-19, figures 1-11.
 103. MONOD, T., 1938, Decapoda Brachyura. Mission Robert Ph. Dollfus en Égypte. VIII. *Mém. Inst. Égypte*, 37, 91-162, figures 1-29.
 104. MONOD, T., 1956, Hippidea et Brachyura ouest-africains. *Mém. Inst. Franc. Afr. Noire*, 45, 1-674, figures 1-884, tables 1-10.
 105. MORRIS, M. C. and BENNETT, I., 1952, The Life-History of a Penaeid Prawn (*Metapenaeus*) breeding in a coastal lake (Tuggerah, New South Wales). *Proc. Linn. Soc. New S. Wales*, 76, 164-182, textfigures 1-96, plate 12.
 106. NARDO, G. D., 1847, *Sinonimia moderna delle specie registrate nell'opera intitolata: Descrizione de' Crostacei, de' Testacei e de' Pesci che abitano le lagune e golfo veneto rappresentati in figure, a chiaro-scuro ed a colori Dall'Abate Stefano Chiereghini Ven. Clodiense applicata per commissione governativa dal Dr. Gio. Domenico Nardo, I-XI*, 1-127.
 107. NARDO, G. D., 1869, Annotazioni illustranti cinquantaquattro specie di Crostacei (Poddalmi, Stomapodi, Edriottalmi e Succhiatori) del mare Adriatico precedute dalla storia antica e recente della carcinologia Adriatica. *Mem. Ist. Venet. Sci. Lett. Art.*, 14, 1-127, plates 1-4.

108. NAYLOR, E., 1957, *Brachynotus sexdentatus* (Risso), a grapsoid Crab new to Britain. *Ann. Mag. nat. Hist.*, ser 12, 10, 521-523, figure 1.
109. NINNI, E., 1923, Primo contributo allo studio dei Pesci e della Pesca nelle acque dell' Impero Ottomano. Materiali raccolti durante la campagna talassografica 1921-22 a bordo della R. Nave L. F. Marsigli. *Miss. Ital. Explor. Mari Levante* (R. N. Marsigli), 5, 1-187, textfigures 1-25, plates 1-16, 1 chart.
110. NOUVEL, H. and HOLTHUIS, L. B., 1957, Les Processidae (Crustacea Decapoda Nantantia) des eaux européennes. *Zool. Verhand. Leiden*, (32), 1-53, figures 1-220.
111. NOUVEL, L., 1941, Contribution à l'étude systématique des Athanas (Crustacés décapodes nageurs) des côtes de France. *Bull. Inst. océanogr. Monaco*, (806), 1-15, figs. 1-4.
112. ODHNER, T., 1925, Monographierte Gattungen der Krabbenfamilie Xanthidae. I. Göteborg. *K. Vetensk. Vitterb. Samh. Handl.*, ser. 4, 29, (1), 1-92, textfigures 1-7, plates 1-5.
113. OLIVI, G., 1792, *Zoologia Adriatica ossia Catalogo ragionato degli Animali del Golfo e delle Lagune di Venezia; preceduto da una Dissertazione sulla Storia fisica e naturale del Golfo; e accompagnato da Memorie, ed Osservazioni di Fisica Storia naturale ed Economia*, 1-334, I-XXXII, plates 1-9.
114. OLIVIER, G. A., 1802, *Voyage dans l'Empire Othoman, l'Egypte et la Perse, fait par ordre du Gouvernement, pendant les six premières années de la République*, 4, 1-456.
115. OSTROUMOFF, A., 1896, Comptes-rendus des dragages et du plancton de l'expédition de "Selianik". *Bull. Acad. Sci. St. Petersb.*, ser. 5, 5, 33-92.
116. PARISI, B., 1913, Decapodi. Escursioni Zoologiche del Dr. Enrico Festa nell' Isola di Rodi. *Boll. Mus. Zool. Anat. comp. Torino*, 28 (677), 1-2.
117. PESTA, O., 1916, Sind die Dekapoden der Adria "gut" bekannt. *Ann. naturh. Hofmus. Wien*, 30, 226-229, plate 6.
118. PESTA, O., 1918, *Die Decapodenfauna der Adria. Versuch einer Monographie*, I-X, 1-500, textfigures 1-150, 1 map.
119. PFEFFER, G., 1889, Uebersicht der von Herrn Dr. Franz Stuhlmann in Ägypten, auf Sansibar und dem gegenüberliegenden Festlande gesammelten Reptilien, Amphibien, Fische, Mollusken und Krebse. *Jb. Hamb. wiss. Anst.*, 6 (2), 1-36.
120. PLATEAU, F., 1887, Sur deux Crustacés recueillis en juin 1883 dans l'île de Chypre, par M. Julien Deby. *C. R. Soc. ent Belg.*, ser. 3, (48), cclx-cclxi.
121. RACEK, A. A., 1955, Littoral Penaeinae from New South Wales and adjacent Queensland Waters. *Aust. Journ. mar. freshw. Research*, 6 (2), 209-241, textfigures 1-2, plates 1-9.
122. RAFINESQUE-SCHMALTZ, C. S., 1814, *Précis des découvertes et travaux somiologiques de Mr. C. S. Rafinesque-Schmaltz entre 1800 et 1814. Ou choix raisonné de ses principales Découvertes en Zoologie et en Botanique, pour servir d'introduction à ses ouvrages futurs*, 1-55.
123. RATHBUN, M. J., 1897, Synopsis of the American species of *Palicus Philippi* (= *Cymopolia* Roux), with descriptions of six new species. *Proc. biol. Soc. Wash.*, 11, 93-99.
124. RATHBUN, M. J., 1915, *Cymopolia* versus *Palicus*. *Proc. biol. Soc. Wash.*, 28, 180.
125. RATHBUN, M. J., 1930, The Cancroid Crabs of America of the Families Euryalidae, Portunidae, Atelecyclidae, Cancridae and Xanthidae. *Bull. U. S. Nat. Mus.*, 152, i-xvi, 1-609, textfigures 1-85, plates 1-230.
126. RATHKE, H., 1837, Zur Fauna der Krym. Ein Beitrag. *Mém. Acad. Sci. Petersb.*, ser. 6B, 3, 291-454, plates 1-10.
127. RAULIN, V., 1870, Description physique de l'île de Crète (Fin). *Actes Soc. Linn. Bordeaux*, 24 (=ser. 3, 4), 353-770.
128. RISSO, A., 1816, *Histoire naturelle des Crustacés des environs de Nice*, 1-175, plates 1-3.
129. ROUX, P., 1828-1830, *Crustacés de la Méditerranée et de son littoral*, plates 1-45.
130. SANTUCCI, R., 1928, Alcuni Crostacei Decapodi delle isole Egee. Ricerche faunistiche nelle isole italiane dell' Egeo. *Arch. zool. Ital.*, 12, 345-354.
131. SAVIGNY, J. C., 1817, *Crustacés. Description de l'Égypte, ou recueil des observations et des recherches qui ont été faites en Égypte pendant l'expédition de l'armée française, atlas Crust.*, plates 1-13.
132. SHARP, B., 1893, Catalogue of the Crustaceans in the Museum of the Academy of Natural Sciences of Philadelphia. *Proc. Acad. nat. Sci. Phila.*, 104-127.

133. STEINDACHNER, F., 1891, Vorläufiger Bericht über die zoologischen Arbeiten im Sommer 1891. Veröffentlichungen der Commission für Erforschung des östlichen Mittelmeeres. *Sitz. Ber. Akad. Wiss. Wien*, 100, 435-447.
134. STEINITZ, W., 1929, Die Wanderung indopazifischer Arten ins Mittelmeer seit Beginn der Quartärperiode. *Int. Rev. ges. Hydrobiol. Hydrogr.*, 22, 1-90, figures 1-9.
135. STEINITZ, W., 1932, Eine neue Garnelenart: *Metapenaeus palaestinensis*. *Zool. Anz.* 100, 161-164, figures 1-3.
136. STEINITZ, W., 1932a, Eine auffallende Zeichnungsvarietät von *Neptunus hastatus* (Liné), *Zool. Anz.*, 100, 132-133.
137. STEINITZ, W., 1933, Beiträge zur Kenntnis der Küstenfauna Palästinas. II. *Pubbl. Staz. Zool. Napoli*, 13, 143-154, figures 1-3.
138. STEINITZ, W., 1933a, Nachtrag und Berichtigung zu meinem Beitrag "Eine neue Garnelenart: *Metapenaeus palaestinensis*". *Zool. Anz.*, 102, 338-339.
139. STEPHENSEN, K., 1923, Decapoda-Macrura excl. Sergestidae. (Penaeidae, Pasiphaeidae, Hoplophoridae, Nematocarcinidae, Scyllaridae, Eryonidae, Nephropsidae, Appendix). *Rep. Danish oceanogr. Exped. Mediterr.*, 2 (D3), 1-85, figures 1-27, charts 1-8.
140. STEPHENSEN, K., 1945, The Brachyura of the Iranian Gulf. With an Appendix: The male pleopoda of the Brachyura. *Danish sci. Invest. Iran*, 4, 57-237, figures 1-60.
141. STIMPSON, W. 1861, Notes on certain Decapod Crustacea. *Proc. Acad. nat. Sci. Phila.*, 372-373.
142. THOMPSON, D. W., 1910, *Historia Animalium*. In: Smith, J. A. & Ross, W. D., The Works of Aristotle translated into English, 4, i-xv, par. 486-633, + 30 pp. (alterations + index), figures.
143. THOMPSON, D. W., 1912, Lobsters in the Aegean. *Nature, Lond.*, 89, 321.
144. TORTONESE, E., 1947, Note interna alla fauna e flora marine dell' Isola di Rodi (Mar Egeo). *Boll. Pesca Piscicolt. Idrobiol. Roma*, 23, 13-20.
145. TORTONESE, E., 1947a, Biological Investigations in the Aegean Sea. *Nature, Lond.*, 159, 887.
146. TORTONESE, E., 1947b, Biologia del Canale di Suez. *Historia Naturalis, Roma*, 2, (2-4), 41-46.
147. TORTONESE, E., 1951, I caratteri biologici del Mediterraneo orientale e i problemi relativi. *Attual. zool. Torino*, 7, 207-251.
148. TORTONESE, E., 1952, Some field-notes on the fauna of the Suez Canal (Timsah and Bitter Lakes). *Publ. Hydrol. Res. Inst. Fac. Sci. Univ. Istanbul*, ser. B. 1 (1), 1-6.
149. UNGER, F. and KOTSCHY, T., 1865, Die Insel Cypern ihrer physischen und organischen Natur nach mit Rücksicht auf ihre frühere Geschichte, i-xii, 1-598, frontisp., 42 textfigures., 1 map.
150. WIRSZUBSKI, A., 1953, On the biology and biotope of the Red Mullet *Mullus barbatus* L.. *Bull. Sea Fish. Research Sta. Caesarea*, (7), 1-20, plates 1-32.
151. ZARIQUIEY ALVAREZ, R., 1946, Crustáceos Decápodos Mediterráneos. Manuel para la clasificación de las especies que pueden capturarse en las costas mediterráneas españolas. *Publ. Biol. Medit. Inst. Esp. Est. Medit.*, 2, 1-181, textfigures. 1-174, plates 1-26.
152. ZARIQUIEY ALVAREZ, R., 1948, Formas mediterráneas nuevas o interesantes. Decapodos españoles. I. *Eos, Madrid*, 24, 257-309, figures 1-34, plates 21-26.
153. ZARIQUIEY ALVAREZ, R., 1950, Galathea bolivari n. sp. Decapodos Españoles. V. *Eos, Madrid*, vol. extr., 311-314.
154. ZARIQUIEY ALVAREZ, R., 1951, Sobre el género Porcellana Lamarck, 1801. Decápodos españoles. IV. *Publ. Inst. Biol. apl. Barcelona*, 9, 131-139, figures 1-2.
155. ZARIQUIEY ALVAREZ, R., 1952, Crustáceos Decápodos recogidos por el Dr. Rutllant en aguas de Melilla. *Fauna Mogrebica*, 1-56, figures 1-6.
156. ZARIQUIEY ALVAREZ, R., 1955, El *Macropipus parvulus* (Parisi 1915) es especie válida. Decápodos españoles. X. *Publ. Inst. Biol. apl. Barcelona*, 21, 91-100, plates 1-2.
157. ZARIQUIEY ALVAREZ, R., 1956, Crustáceos Decápodos de la region de Cadaqués (España). Etudes carcinologiques méditerranéennes I. *Vie et Milieu*, 6, 397-409, figures 1, 2.

NOTICE TO CONTRIBUTORS

Contributors to the *Bulletin of the Research Council of Israel* should conform to the following recommendations of the editors of this journal in preparing manuscripts for the press.

Contributions must be original and should not have been published previously. When a paper has been accepted for publication, the author(s) may not publish it elsewhere unless permission is received from the Editor of this journal.

Papers may be submitted in English, French and Russian.

MANUSCRIPT

General

Papers should be written as concisely as possible. MSS should be typewritten on one side only and double-spaced, with side margins not less than 2.5 cm wide. Pages, including those containing illustrations, references or tables, should be numbered.

The Editor reserves the right to return a MS to the author for retyping or any alterations. Authors should retain copies of their MS.

Spelling

Spelling should be based on the Oxford Dictionary and should be consistent throughout the paper. Geographic and proper names in particular should be checked for approved forms of spelling or transliteration.

Indications

Greek letters should be indicated in a legend preceding the MS, as well as by a pencil note in the margin on first appearance in the text.

When there is any room for confusion of symbols, they should be carefully differentiated, e.g. the letter "l" and the figure "1"; "O" and "0".

Abbreviations

Titles of journals should be abbreviated according to the *World List of Scientific Periodicals*.

Abstract

Every paper must be accompanied by a brief but comprehensive abstract. Although the length of the abstract is left to the discretion of the author, 3% of the total length of the paper is suggested.

References

In Sections A and C, and in Letters to the Editor in all Sections, references are to be cited in the text by number e.g., ... Taylor³ ... and are to be arranged in the order of appearance.

In Sections B, D and E, the references are to be cited in the text by the author's name and date of publication in parenthesis, e.g., ... (Taylor 1932) ... If the author's name is already mentioned in the text, then the year only appears in the parenthesis, e.g., ... found by Taylor (1932) ... The references in these Sections are to be arranged in alphabetical order.

The following form should be used:

3. TAYLOR, G. I., 1932, *Proc. roy. Soc.*, A138, 41.

Book references should be prepared according to the following form.

4. JACKSON, F., 1930, *Thermodynamics*, 4th ed., Wiley, New York

TYPOGRAPHY

In all matters of typography the form adopted in this issue should be followed. Particular attention should be given to position (of symbols, headings, etc.) and type specification.

ILLUSTRATIONS

Illustrations should be sent in a state suitable for direct photographic reproduction. Line drawings should be drawn in large scale with India ink on white drawing paper, bristol board, tracing paper, blue linen, or blue-lined graph paper. If the lettering cannot be drawn neatly by the author, he should indicate it in pencil for the guidance of the draftsman. Possible photographic reduction should be carefully considered when lettering and in other details.

Half tone photographs should be on glossy contrast paper.

Illustrations should be mounted on separate sheets of paper on which the caption and figure number is typed. Each drawing and photograph should be identified on the back with the author's name and figure number.

The place in which the figure is to appear should be indicated in the margin of the MS

PROOFS

Authors making revisions in proofs will be required to bear the costs thereof. Proofs should be returned to the Editor within 24 hours, otherwise no responsibility is assumed for the corrections of the author.

REPRINTS

Reprints may be ordered at the time the first proof is returned. A table designating the cost of reprints may be obtained on request.

ABC BOOKSTORE

SPECIALIST IN SCIENTIFIC AND TECHNICAL BOOKS

Orders from all countries accepted

Israel Distributor for The Weizmann Science Press Jerusalem

TEL-AVIV, 71 ALLENBY ROAD • PHONE 64058

יוצא לאור ע"י

מוסד ויצמן לפרסומים במדעי הטבע ובטכנולוגיה בישראל

המועצה המדעית לישראל - משרד החינוך והתרבות - האוניברסיטה העברית בירושלים
הטכניון—מכון טכנולוגי לישראל - מכון ויצמן למדע - מוסד ביאליק

Published by

THE WEIZMANN SCIENCE PRESS OF ISRAEL

Research Council of Israel, Ministry of Education and Culture

The Hebrew University of Jerusalem, Technion—Israel Institute of Technology

The Weizmann Institute of Science, Bialik Institute

Printed in Israel

Printing Press Gesher, Jerusalem

WSP/1000/9.58